

ELECTROMAGNETIC EMISSIONS COMPLIANCE REPORT

INTENTIONAL RADIATOR CERTIFICATION TO FCC PART 15 SUBPART C REQUIREMENT

OF

Product Name: TF600TL
Brand Name: ASUS
Marketing Name: TF600TL
Model No.: TF600TL
Model Difference: N/A
FCC ID: MSQTF600TL
Report No.: EH/2012/50048
Issue Date: Sep. 07, 2012
FCC Rule Part: §15.247, Cat: DSS
Prepared for: ASUSTeK Computer Inc.
15, Li-Te Rd., Peitou, Taipei 112, Taiwan
Prepared by: SGS Taiwan Ltd.
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VERIFICATION OF COMPLIANCE

Applicant: ASUSTeK Computer Inc.
15, Li-Te Rd., Peitou, Taipei 112, Taiwan

Product Name: TF600TL

Brand Name: ASUS

Marketing Name: TF600TL

Model No.: TF600TL

Model Difference: N/A

FCC ID: MSQTF600L

File Number: EH/2012/50048

Date of test: May 31, 2012 ~ Sep. 05, 2012

Date of EUT Received: May 31, 2012

We hereby certify that:

The above equipment was tested by SGS Taiwan Ltd. The test data, data evaluation, test procedures, and equipment configurations shown in this report were made in accordance with the procedures given in ANSI C63.4:2009 and the energy emitted by the sample EUT tested as described in this report is in compliance with conducted and radiated emission limits of FCC Rules Part 15.247.

The test results of this report relate only to the tested sample identified in this report.

Test By:

Lion Wang

Date:

Sep. 07, 2012

Lion Wang / Engineer

Prepared By:

Judy Hsu

Date:

Sep. 07, 2012

Judy Hsu / Clerk

Approved By:

Jim Chang

Date:

Sep. 07, 2012

Jim Chang / Supervisor

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Version

Version No.	Date	Description
00	Sep. 07, 2012	Initial creation of document

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14.1. Standard Applicable63

14.2. Antenna Connected Construction63

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1. GENERAL INFORMATION

1.1. Product Description

General:

Product Name:	TF600TL	
Brand Name:	ASUS	
Marketing Name:	TF600TL	
Model No.:	TF600TL	
Model difference:	N/A	
Data Cable (USB):	Model No.: TF810C USB CABLE; Supplier: LOTES	
Hardware Version:	R1.2	
Software Version:	TF600T_EN_Win8.8428_0.12	
Power Supply:	3.7Vdc form Li-Ion battery or 5Vdc or 15Vdc from adapter.	
	Battery:	Model No.: TF600T BAT ATL LI-POLY FPACK, Supplier: Simplo
	Adapter :	1. Model No.: AD8273, Supplier: PI 2. Model No.: ADP-18BW, Supplier: DELTA

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Bluetooth:

Frequency Range:	2402 – 2480MHz
Bluetooth Version:	V3.0 +HS
Channel number:	79 channels
Modulation type:	GFSK+ π /4DQPSK+8DPSK
Transmit Power:	10.7 dBm (Peak)
Dwell Time:	<= 0.4s
Operating Mode:	Point-to-Point
Antenna Designation:	PIFA Antenna, -1.6dBi.

This test report applies for Bluetooth function.

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1.2. Related Submittal(s) / Grant (s)

This submittal(s) (test report) is intended for FCC ID: MSQTF600TL filing to comply with Section 15.247 of the FCC Part 15, Subpart C Rules.

1.3. Test Methodology

Both conducted and radiated testing was performed according to the procedures in ANSI C63.4: 2009. Radiated testing was performed at an antenna to EUT distance 3 meters.

Tested in accordance with FCC Public Notice DA 00-705

1.4. Test Facility

The measurement facilities used to collect the 3m Radiated Emission and AC power line conducted data are located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 134, Wu Kung Rd., Wuku Industrial Zone, Taipei Country, Taiwan which are constructed and calibrated to meet the FCC requirements in documents ANSI C63.4: 2009. FCC Registration Number are: 990257 and 236194, Canada Registration Number: 4620A-4.

The 10 m Open Area Test Sites located on the address of SGS Taiwan Ltd. Electronics & Communication Laboratory No. 29, Pau-Tou-Tsuo Valley Chia-Pau Tsuen, Linkou Hsiang, Taipei county, which is constructed and calibrated to meet the CISPR 22/EN 55022 requirements. SGS Site No. 1(3 &10 meters) and FCC Registration Number: 94644.

1.5. Special Accessories

Not available for this EUT intended for grant.

1.6. Equipment Modifications

Not available for this EUT intended for grant.

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2. SYSTEM TEST CONFIGURATION

2.1. EUT Configuration

The EUT configuration for testing is installed on RF field strength measurement to meet the Commissions requirement and operating in a manner which intends to maximize its emission characteristics in a continuous normal application.

2.2. EUT Exercise

The EUT (Transmitter) was operated in the engineering mode to fix the Tx frequency that was for the purpose of the measurements.

2.3. Test Procedure

2.3.1 Conducted Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. According to the requirements in Section 7.3.1 of ANSI C63.4: 2009. Conducted emissions from the EUT measured in the frequency range between 0.15 MHz and 30MHz using CISPR Quasi-Peak and Average detector mode.

2.3.2 Radiated Emissions

The EUT is a placed on as turn table which is 0.8 m above ground plane. The turn table shall rotate 360 degrees to determine the position of maximum emission level. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emission. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical. In order to find out the max. emission, the relative positions of this hand-held transmitter (EUT) was rotated through three orthogonal axes and measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna. according to the requirements in Section 8 and 13 and Subclause 8.3.1.2 of ANSI C63.4: 2009 and DA 00-705.

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2.4. Configuration of Tested System

Fig. 2-1 AC Power line and Radiated Emission Configuration

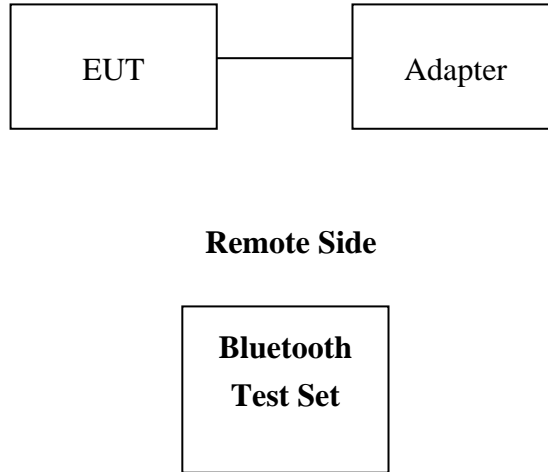


Table 2-1 Equipment Used in Tested System

Item	Equipment	Mfr/Brand	Model/ Type No.	Series No.	Data Cable	Power Cord
1.	Bluetooth Test Set	Anritsu	MT8852B	6k00006107	N/A	N/A

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3. SUMMARY OF TEST RESULTS

FCC Rules	Description Of Test	Result
§15.207(a)	Conducted Emission	Compliant
§15.247(b)(1)	Peak Output Power	Compliant
§15.247(a)	20dB Bandwidth	No Limit
§15.247 (d)	100 KHz Bandwidth Of Frequency Band Edges	Compliant
§15.209(a) (f)	Spurious Emission	Compliant
§15.247(a)(1)	Frequency Separation	Compliant
§15.247(a)(1)(iii)	Number of hopping frequency	Compliant
§15.247(a)(1)(iii)	Time of Occupancy	Compliant
§15.247	Peak Power Density	Compliant
§15.203, §15.247(b)(4)(i)	Antenna Requirement	Compliant

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4. DESCRIPTION OF TEST MODES

The EUT has been tested under operating condition.

Test program used to control the EUT for staying in continuous transmitting and receiving mode is programmed.

Channel low (2402MHz) 、mid (2441MHz) and high (2480MHz) with worst case EDR mode is chosen for full testing.

5. MEASUREMENT UNCERTAINTY FOR FIELD STRENGTH OF SPURIOUS RADIATION

Measurement uncertainty (Polarization : Vertical)	30MHz - 180MHz: 3.37dB
	180MHz -417MHz: 3.19dB
	0.417GHz-1GHz: 3.19dB
	1GHz - 18GHz: 4.04dB
	18GHz - 40GHz: 4.04dB

Measurement uncertainty (Polarization : Horizontal)	30MHz - 167MHz: 4.22dB
	167MHz -500MHz: 3.44dB
	0.5GHz-1GHz: 3.39dB
	1GHz - 18GHz: 4.08dB
	18GHz - 40GHz: 4.08dB

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6. CONDUCTED EMISSION TEST

6.1. Standard Applicable

According to §15.207. frequency within 150KHz to 30MHz shall not exceed the limit table as below.

Frequency range MHz	Limits dB(uV)	
	Quasi-peak	Average
0.15 to 0.50	66 to 56	56 to 46
0.50 to 5	56	46
5 to 30	60	50

Note

- 1.The lower limit shall apply at the transition frequencies
- 2.The limit decreases linearly with the logarithm of the frequency in the range 0.15 MHz to 0.50 MHz.

6.2. EUT Setup

1. The conducted emission tests were performed in the test site, using the setup in accordance with the ANSI C63.4: 2009.
2. The EUT was plug-in the AC/DC Power adapter. The host system was placed on the center of the back edge on the test table. The peripherals was placed on the side of the host PC system. The rear of the EUT and peripherals were placed flushed with the rear of the tabletop.
3. The spacing between the peripherals was 10 centimeters.
4. External I/O cables were draped along the edge of the test table and bundle when necessary.
5. The host system was connected with 120Vac/60Hz power source.

6.3. Measurement Procedure

1. The EUT was placed on a table which is 0.8m above ground plane.
2. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
3. Repeat above procedures until all frequency measured were complete.

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6.4. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013
EMI Receiver	R&S	ESCS 30	828985/004	09/23/2011	09/22/2012
LISN	Rolf-Heine	NNB-2/16Z	99012	03/23/2012	03/22/2013
LISN	FCC	FCC-LISN-50/250-25-2-01	04034	03/23/2012	03/22/2013
Coaxial Cables	N/A	WK CE Cable	N/A	01/05/2012	01/04/2013

6.5. Measurement Result

The initial step in collecting conducted data is a spectrum analyzer peak scan of the measurement range. Significant peaks are then marked as shown on the following data page, and these signals are then quasi-peaked.

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AC POWER LINE CONDUCTED EMISSION TEST DATA

Operation Mode:	Operation	Test Date:	Sep. 05, 2012
Adapter	AD8273	Test By:	Lion



Site: ConductionRoom	Phase: L1	Temperature: 26 °C
Limit: FCC Class B Conduction(QP)	Power: AC 120V/60Hz	Humidity: 60%
EUT: TF600TL	Distance:	
M/N: TF600TL		
Mode: Operation Mode		
Note: Adapter: AD8273		

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.1573	50.52	0.24	50.76	65.61	-14.85	QP	
2		0.1573	32.25	0.24	32.49	55.61	-23.12	AVG	
3		0.1729	48.09	0.23	48.32	64.82	-16.50	QP	
4		0.1729	27.84	0.23	28.07	54.82	-26.75	AVG	
5		0.2399	44.50	0.21	44.71	62.10	-17.39	peak	
6	*	0.4902	42.20	0.22	42.42	56.16	-13.74	peak	
7		0.7854	26.44	0.22	26.66	56.00	-29.34	peak	
8		15.1699	29.53	0.66	30.19	60.00	-29.81	peak	

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Site	ConductionRoom	Phase:	N	Temperature:	25 °C
Limit:	FCC Class B Conduction(QP)	Power:	AC 120V/60Hz	Humidity:	60%
EUT:	TF600TL	Distance:			
M/N:	TF600TL				
Mode:	Operation Mode				
Note:	Adapter: AD8273				

No.	Mk.	Freq.	Reading Level	Correct Factor	Measurement	Limit	Over	Detector	Comment
		MHz	dBuV	dB	dBuV	dBuV	dB		
1		0.1505	51.26	0.34	51.60	65.97	-14.37	QP	
2		0.1505	32.64	0.34	32.98	55.97	-22.99	AVG	
3		0.1806	45.83	0.32	46.15	64.46	-18.31	QP	
4		0.1806	27.50	0.32	27.82	54.46	-26.64	AVG	
5		0.2477	46.48	0.31	46.79	61.83	-15.04	peak	
6	*	0.4824	41.98	0.34	42.32	56.30	-13.98	peak	
7		0.7111	29.72	0.32	30.04	56.00	-25.96	peak	
8		16.5932	29.25	0.66	29.91	60.00	-30.09	peak	

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Operation Mode:	Operation	Test Date:	Sep. 05, 2012
Adapter	ADP-18BW	Test By:	Lion

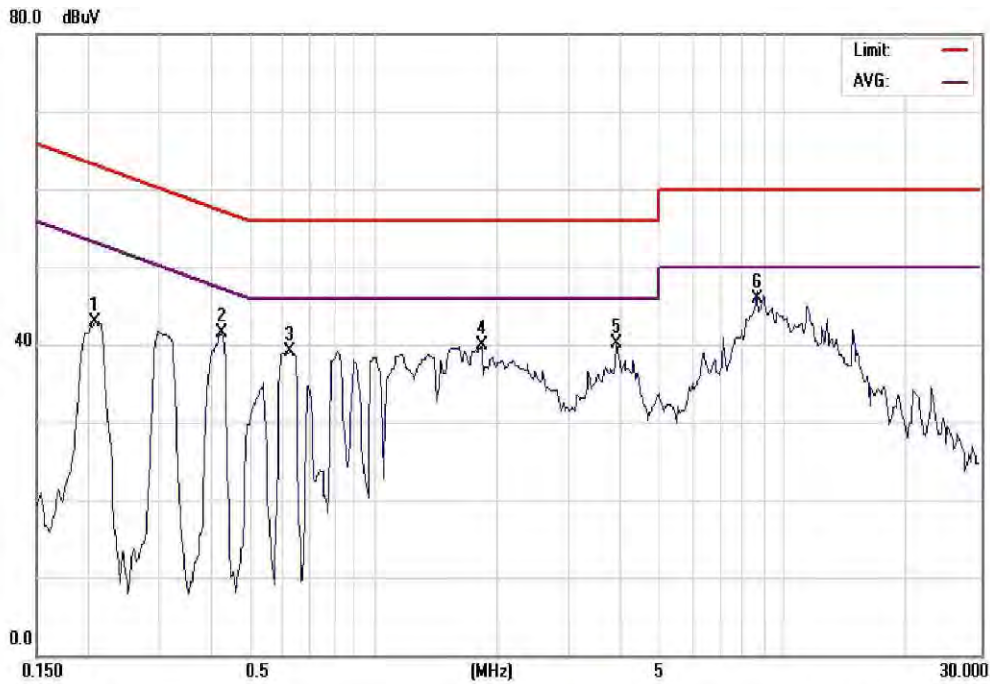


Site ConductionRoom Phase: **L1** Temperature: 26 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 60%
 EUT: TF600TL Distance:
 M/N: TF600TL
 Mode: Operation Mode
 Note: Adapter:ADP-18BW

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1	*	0.2008	46.79	0.21	47.00	63.58	-16.58	peak	
2		0.3181	38.71	0.21	38.92	59.76	-20.84	peak	
3		0.4198	36.84	0.22	37.06	57.45	-20.39	peak	
4		0.8558	36.98	0.22	37.20	56.00	-18.80	peak	
5		1.4032	38.40	0.23	38.63	56.00	-17.37	peak	
6		9.3088	38.22	0.42	38.64	60.00	-21.36	peak	

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Site: ConductionRoom Phase: **N** Temperature: 26 °C
 Limit: FCC Class B Conduction(QP) Power: AC 120V/60Hz Humidity: 60%
 EUT: TF600TL Distance:
 M/N: TF600TL
 Mode: Operation Mode
 Note: Adapter: ADP-18BW

No.	Mk.	Freq. MHz	Reading Level dBuV	Correct Factor dB	Measure- ment dBuV	Limit dBuV	Over dB	Detector	Comment
1		0.2087	42.61	0.31	42.92	63.26	-20.34	peak	
2		0.4276	41.23	0.34	41.57	57.30	-15.73	peak	
3		0.6212	38.73	0.33	39.06	56.00	-16.94	peak	
4		1.8333	39.48	0.33	39.81	56.00	-16.19	peak	
5		3.9134	39.69	0.35	40.04	56.00	-15.96	peak	
6	*	8.6128	45.43	0.43	45.86	60.00	-14.14	peak	

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7. PEAK OUTPUT POWER MEASUREMENT

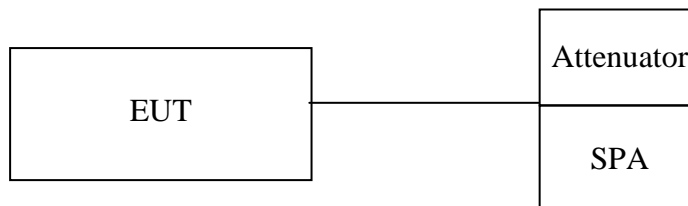
7.1. Standard Applicable

For frequency hopping systems operating in the 2400-2483.5 MHz band employing at least 75 hopping channels, and all frequency hopping systems in the 5725-5850MHz band: 1Watt. For all other frequency hopping systems in the 2400 – 2483.5MHz band: 0.125 Watts.

7.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013
Splitter	Agilent	11636B	N/A	02/28/2012	02/27/2013

7.3. Test Set-up:



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7.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the power meter or spectrum. (BDR model: max peak RBW= 1MHz ,VBW = 3MHz, EDR model: max peak RBW = 1.5MHz VBW = 5MHz)
3. Record the max. reading.
4. Repeat above procedures until all frequency measured were complete.

7.5. Measurement Result

BDR Mode

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	10.04	10.04	0.01009	0.125
2441.00	10.39	10.39	0.01094	0.125
2480.00	9.94	9.94	0.00986	0.125

**Note: offset 3.7dB*

EDR Mode

Frequency (MHz)	Reading Power (dBm)	Output Power (dBm)	Output Power (W)	Limit (W)
2402.00	10.38	10.38	0.01091	0.125
2441.00	10.70	10.70	0.01175	0.125
2480.00	10.22	10.22	0.01052	0.125

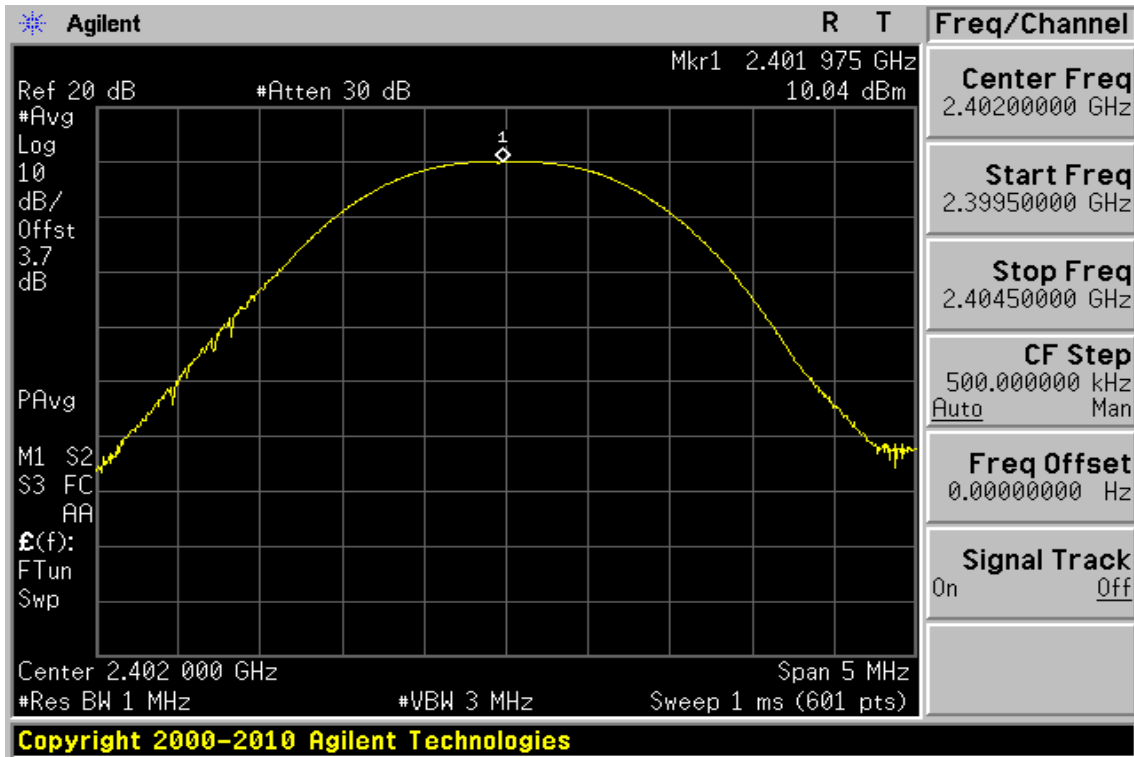
**Note: offset 3.7dB*

Note: Refer to next page for plots.

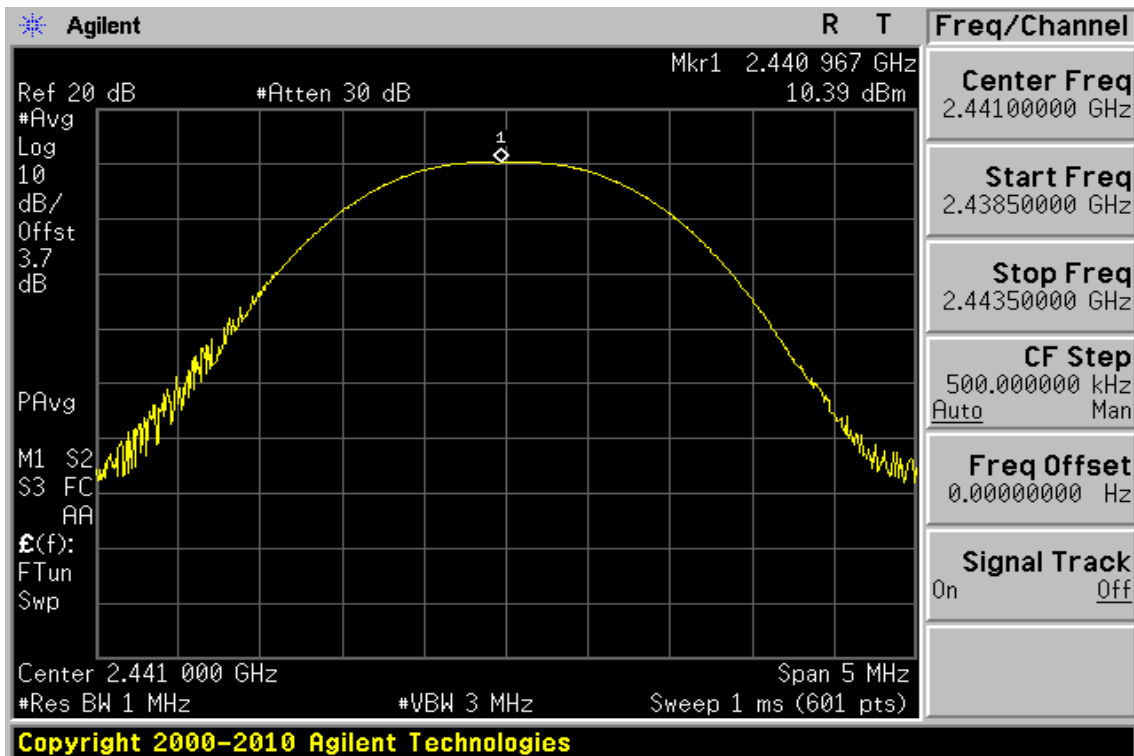
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Peak Power Output Data Plot (CH Low) (BDR mode)



Peak Power Output Data Plot (CH Mid) (BDR mode)



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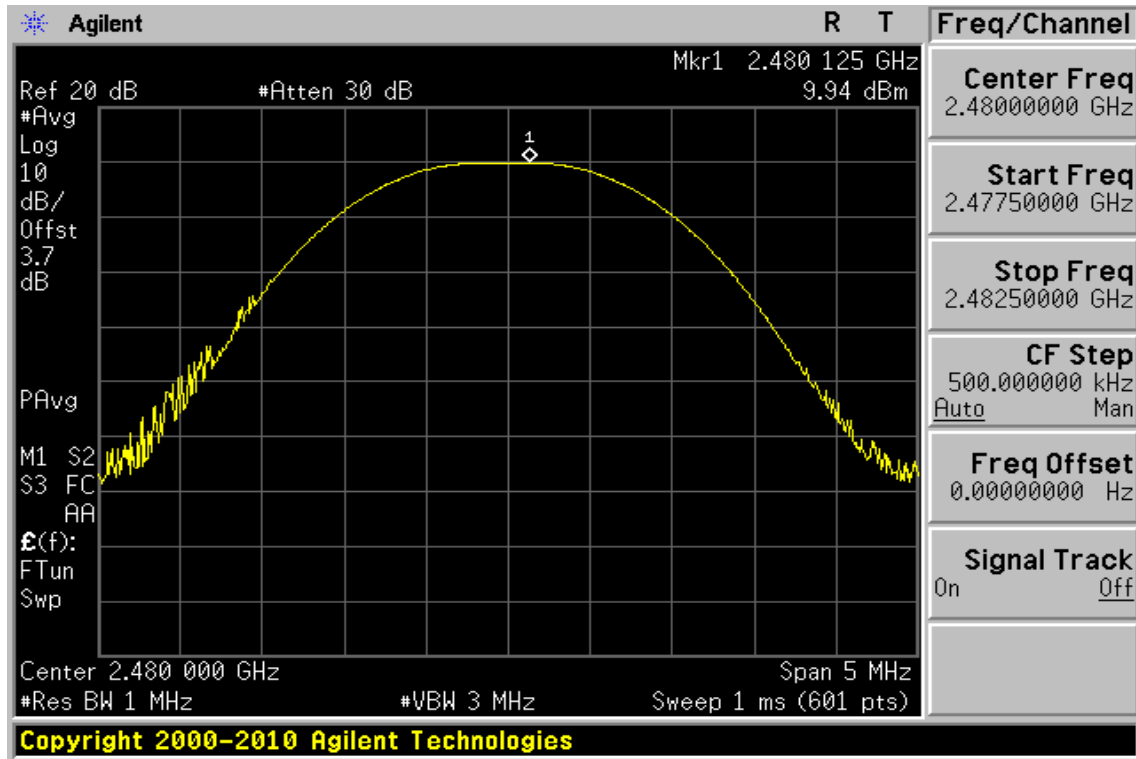
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Peak Power Output Data Plot (CH High) (BDR mode)



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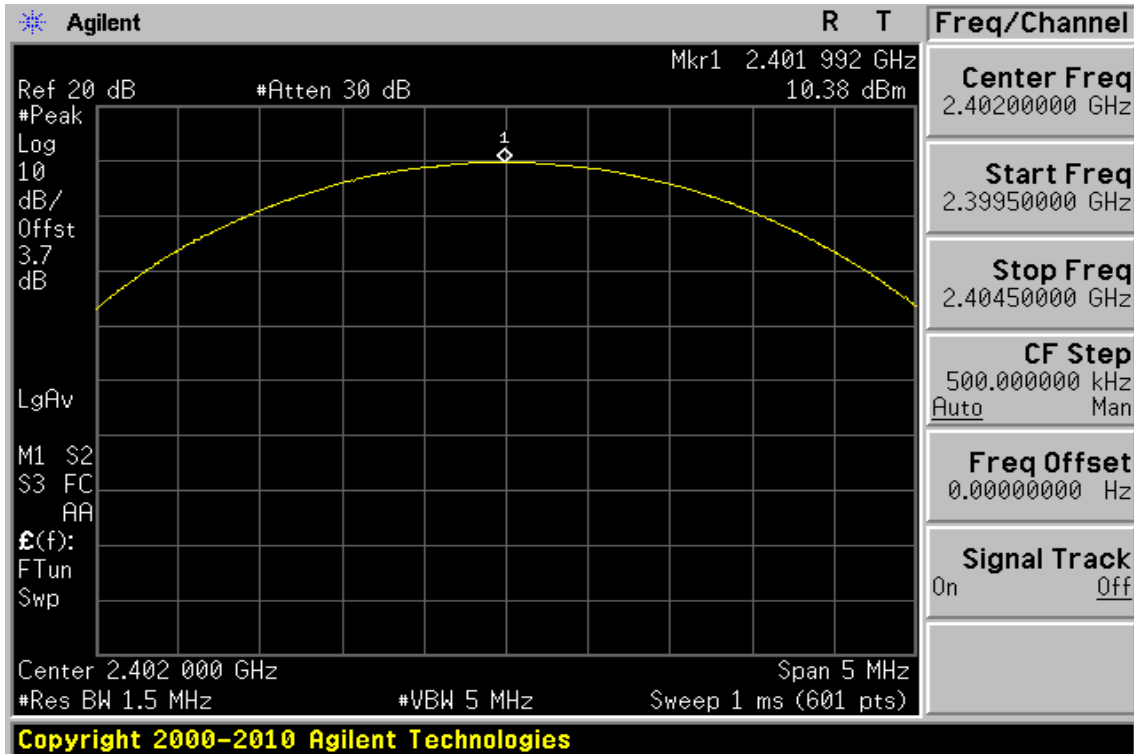
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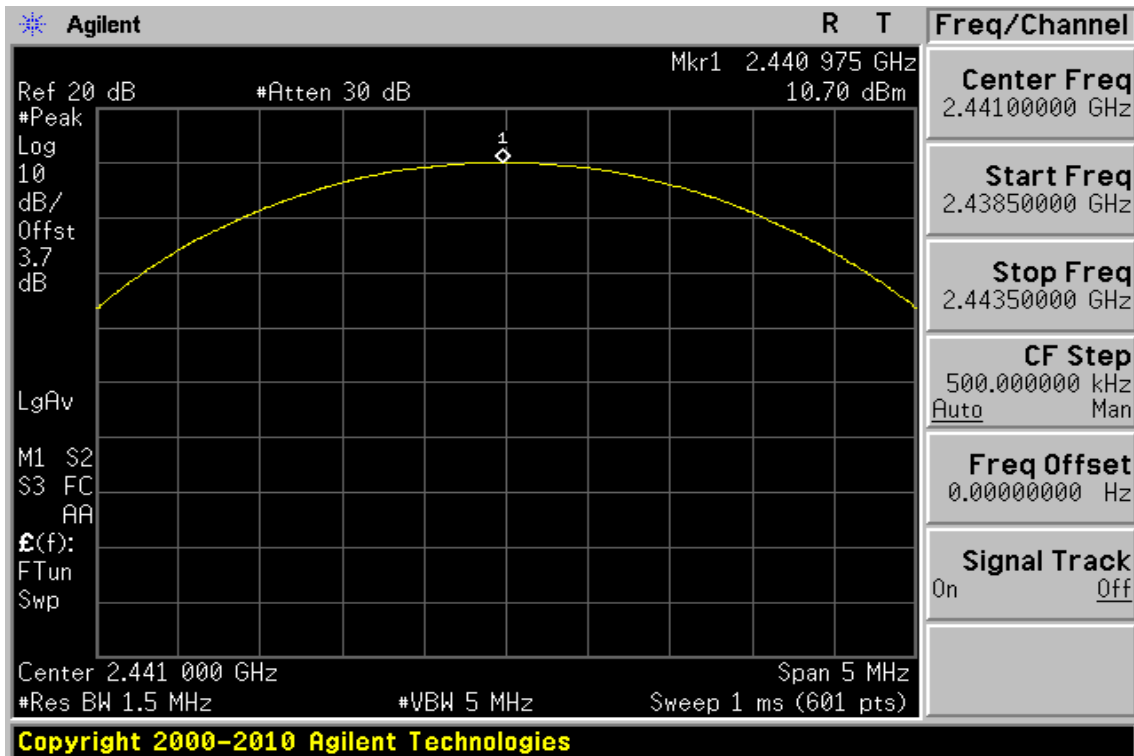
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Peak Power Output Data Plot (CH Low) (EDR mode)



Peak Power Output Data Plot (CH Mid) (EDR mode)



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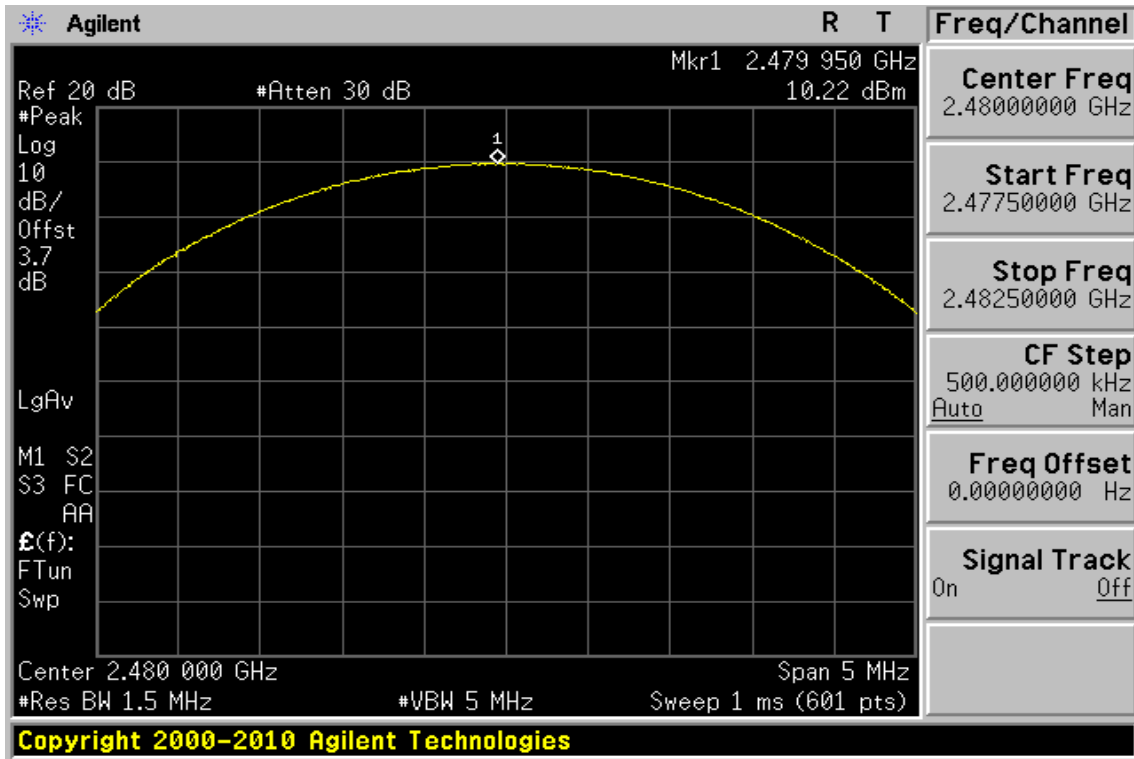
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Peak Power Output Data Plot (CH High) (EDR mode)



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8. 20dB BAND WIDTH

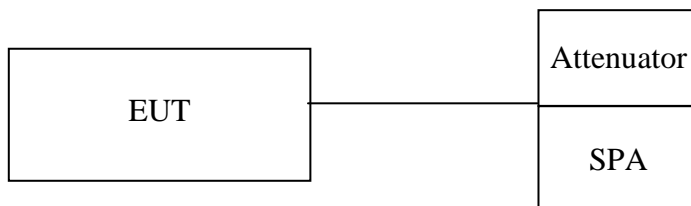
8.1. Standard Applicable

For frequency hopping systems operating in the 2400MHz-2483.5 MHz no limit for 20dB bandwidth.

8.2. Measurement Equipment Used

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Power Sensor	Anritsu	ML2495A	1005007	02/08/2012	02/07/2014
Power Meter	Anritsu	MA2411B	917032	02/08/2012	02/07/2014
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013
Splitter	Agilent	11636B	N/A	02/28/2012	02/27/2013

8.3. Test Set-up



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8.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set the spectrum analyzer as $RBW > 1\%$ of Bandwidth., $VBW > RBW$, Span= 3MHz, Sweep=auto
4. Mark the peak frequency and -20dB (upper and lower) frequency.
5. Repeat above procedures until all frequency measured were complete.

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8.5. Measurement Result:

20dB Bandwidth : BDR mode

CH	Bandwidth (MHz)
Lower	0.922
Mid	0.923
Higher	0.887

Note: Offset: 3.7 dB

20dB Bandwidth : EDR mode

CH	Bandwidth (MHz)	2/3 Bandwidth (MHz)
Lower	1.337	0.891
Mid	1.335	0.890
Higher	1.341	0.894

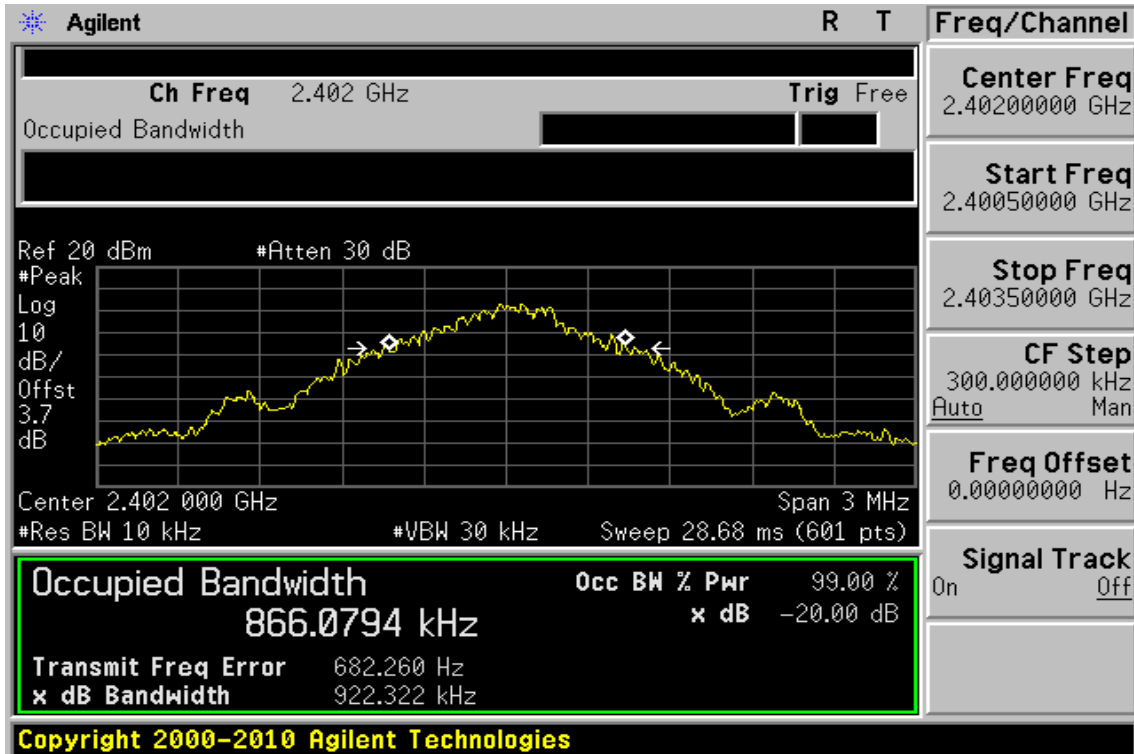
Note: Offset: 3.7dB

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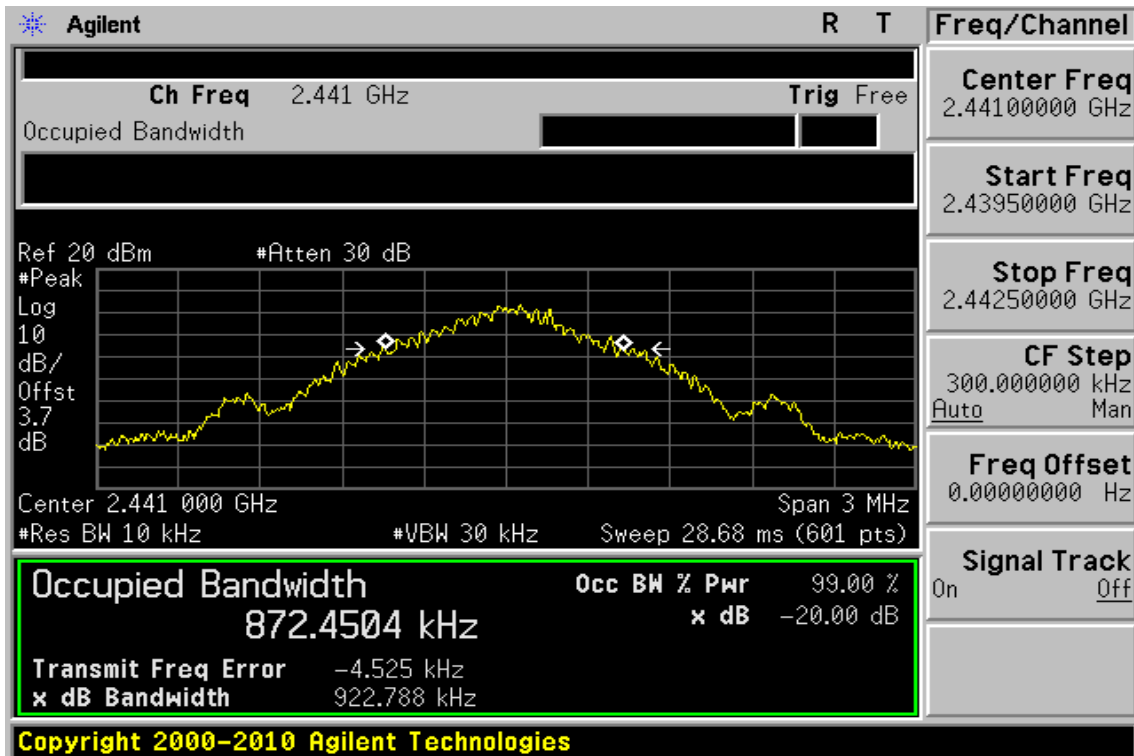
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20dB Band Width Test Data CH-Low (BDR mode)



20dB Band Width Test Data CH-Mid (BDR mode)



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20dB Band Width Test Data CH-High (BDR mode)



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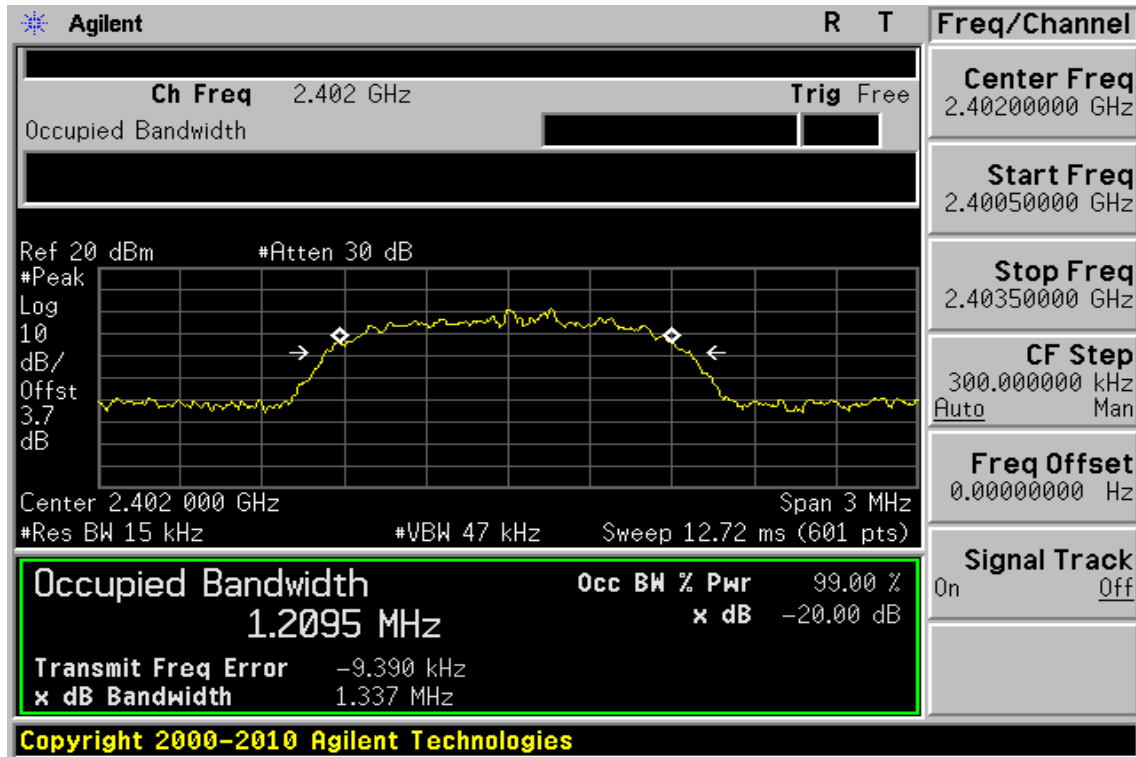
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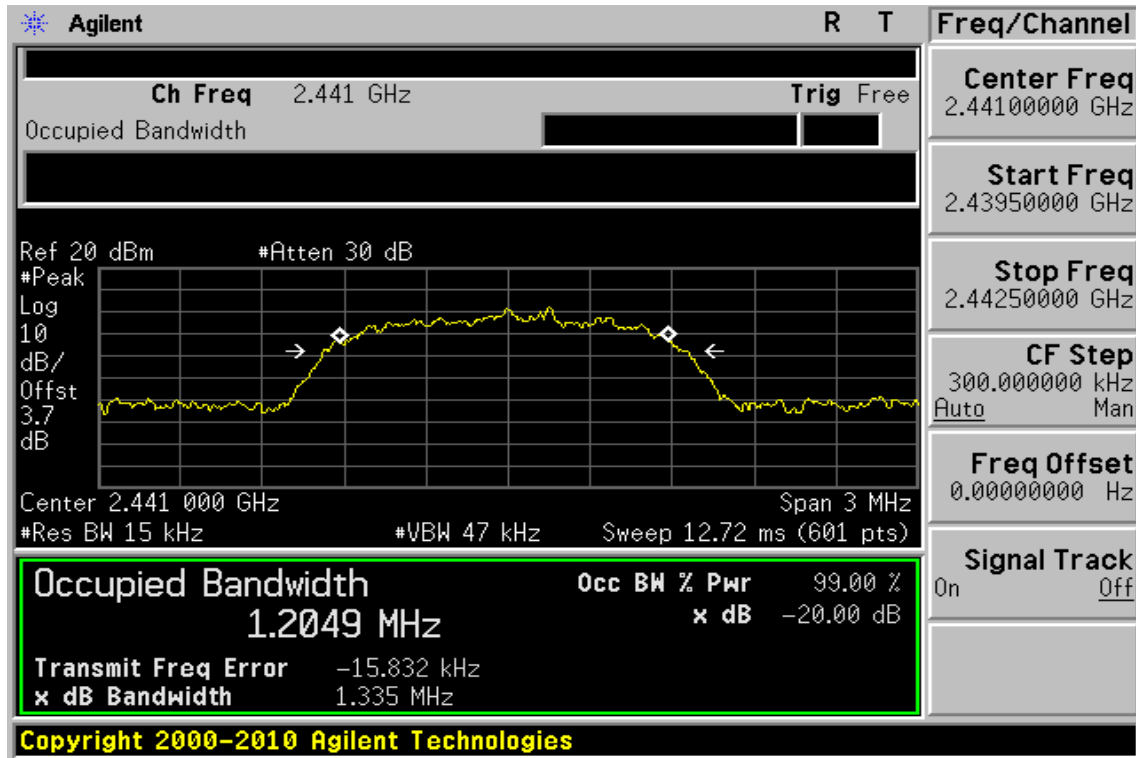
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20dB Band Width Test Data CH-Low (EDR mode)



20dB Band Width Test Data CH-Mid (EDR mode)

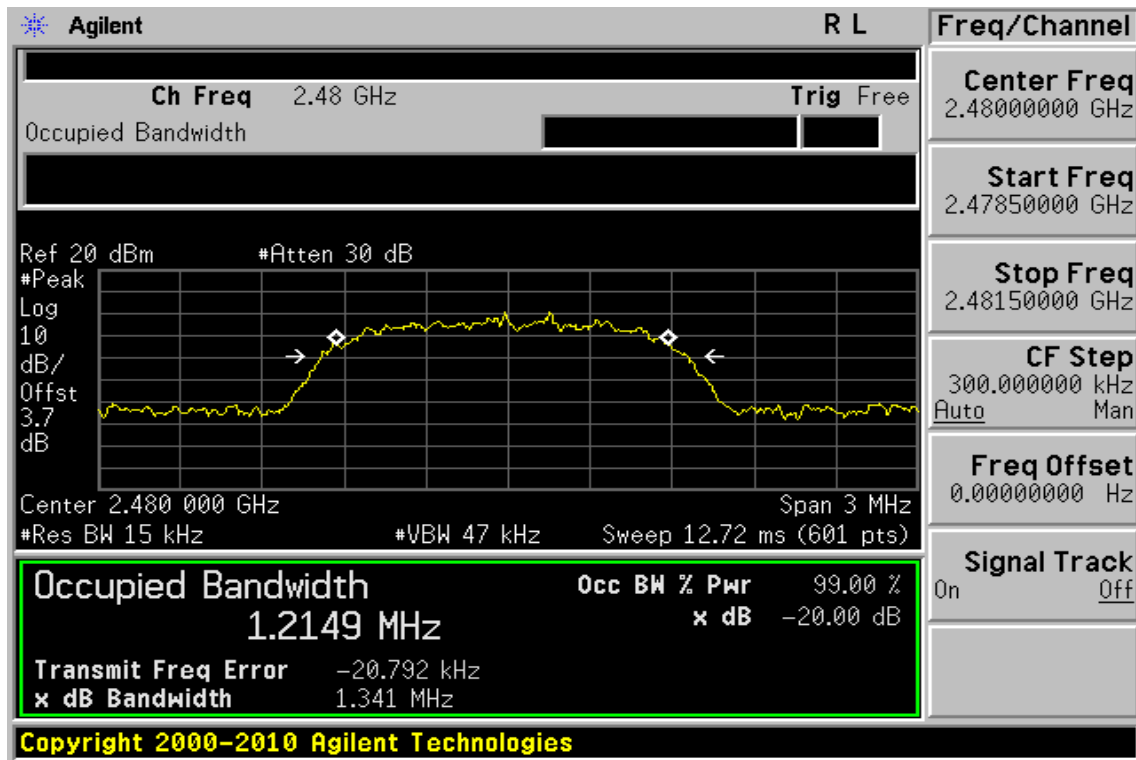


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20dB Band Width Test Data CH-High (EDR mode)



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9. 100KHz BANDWIDTH OF BAND EDGES and Out-Of-Band EMISSION MEASUREMENT

9.1. Standard Applicable

According to §15.247(c), in any 100 KHz bandwidth outside the frequency bands in which the spread spectrum intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20dB below that in the 100KHz bandwidth within the band that contains the highest level of the desired power, In addition, radiated emissions which fall in the restricted bands, as defined in §15.205(a), must also comply with the radiated emission limits specified in §15.209(a).

9.2. Measurement Equipment Used

9.2.1. Conducted Emission at antenna port:

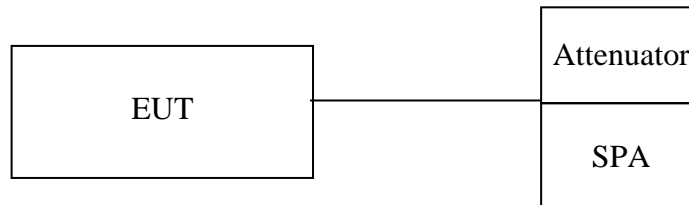
Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013

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9.3. Test SET-UP:

9.3.1. Conducted Emission at antenna port:



9.4. Measurement Procedure

100KHz BANDWIDTH OF BAND EDGES:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW, VBW=100KHz, Span=25MHz, Sweep = auto
5. Mark Peak, 2.390GHz and 2.4835GHz and record the max. level.
6. Repeat above procedures until all frequency measured were complete.

Out-Of-Band EMISSION:

1. To connect Antenna Port of EUT to Spectrum.
2. Set RBW = 100K & VBW = 100K on Spectrum.
3. Sweep the frequency to determine spurious emission as seen on spectrum from span of 30 to 3G, 3G to 8G, 8G to 13G, 13G to 18G and 18G to 26.5GHz
4. Via Software, combine 5 spans of frequency range into one plot

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9.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

9.6. Measurement Result

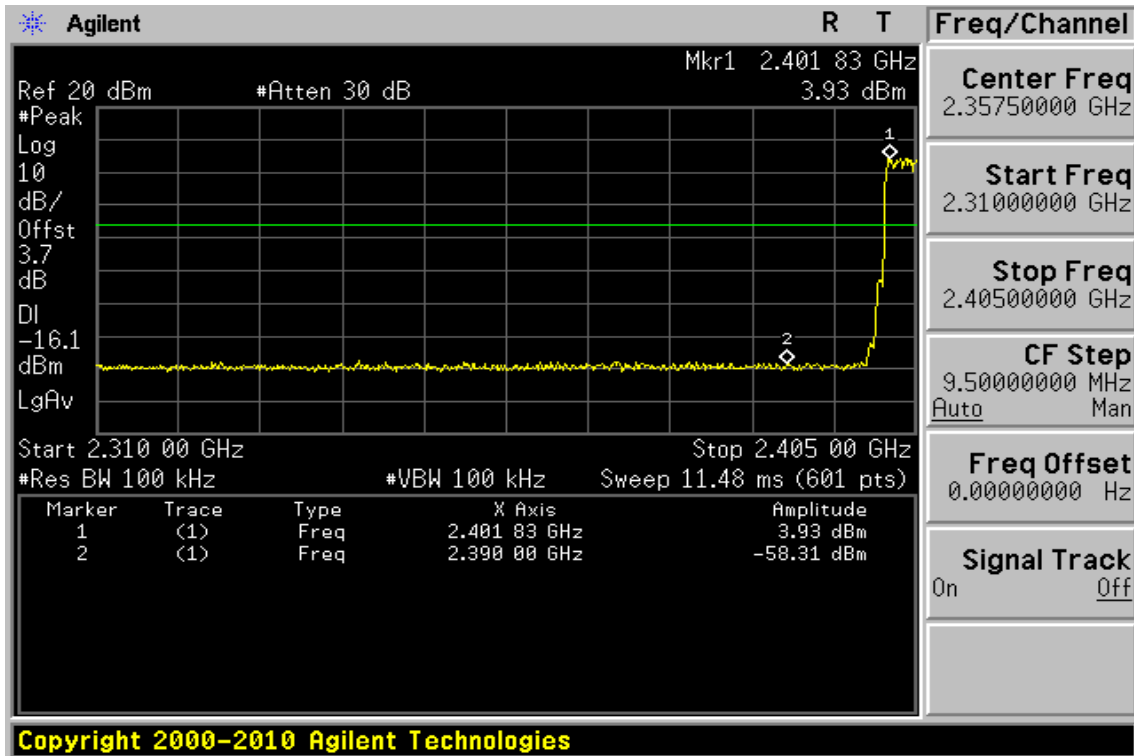
Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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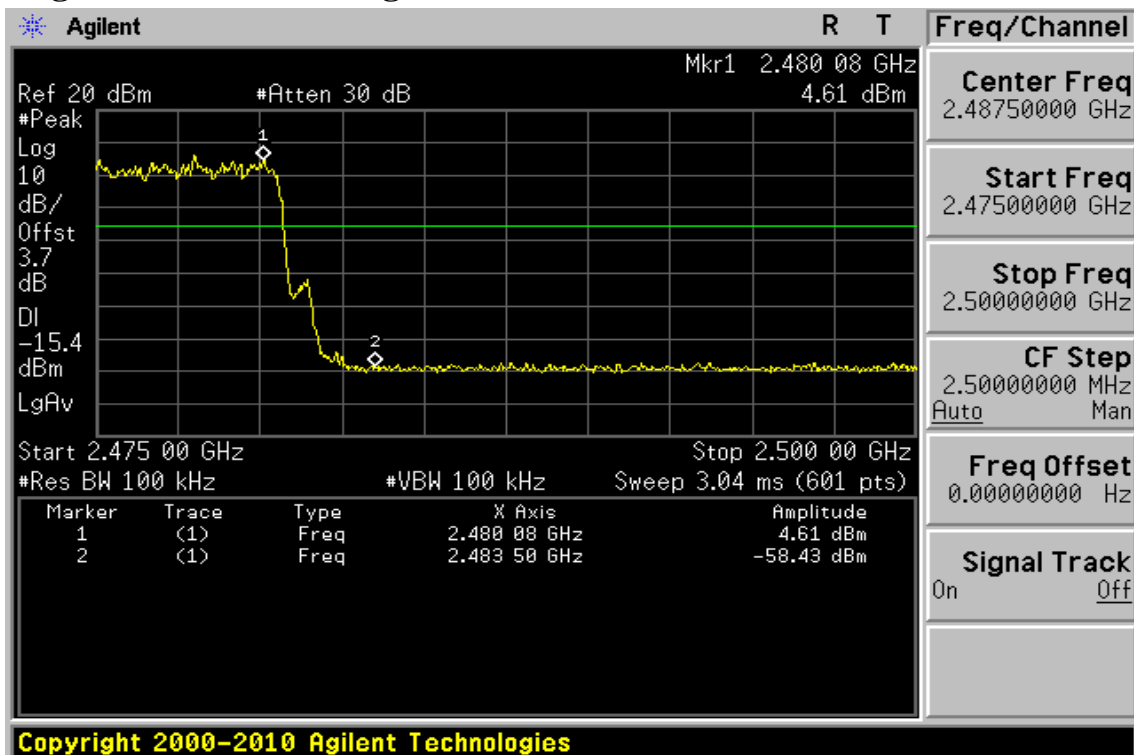
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Band Edges Test Data CH-Low (Worst: EDR mode)



Band Edges Test Data CH-High

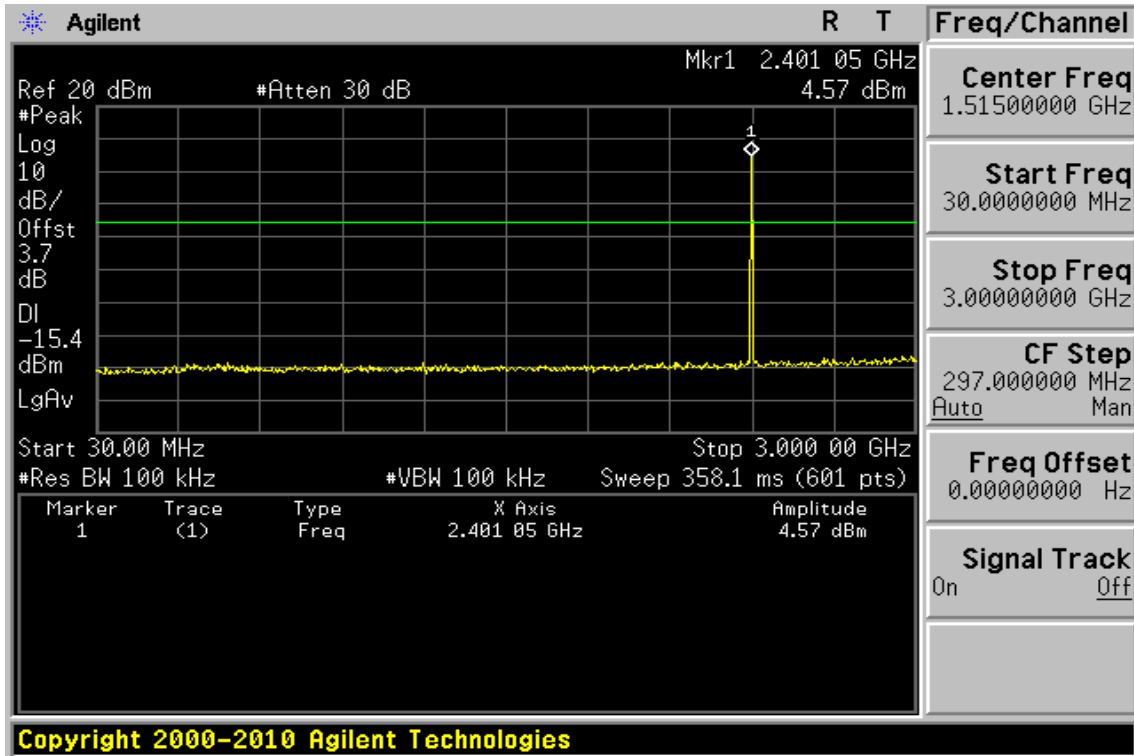


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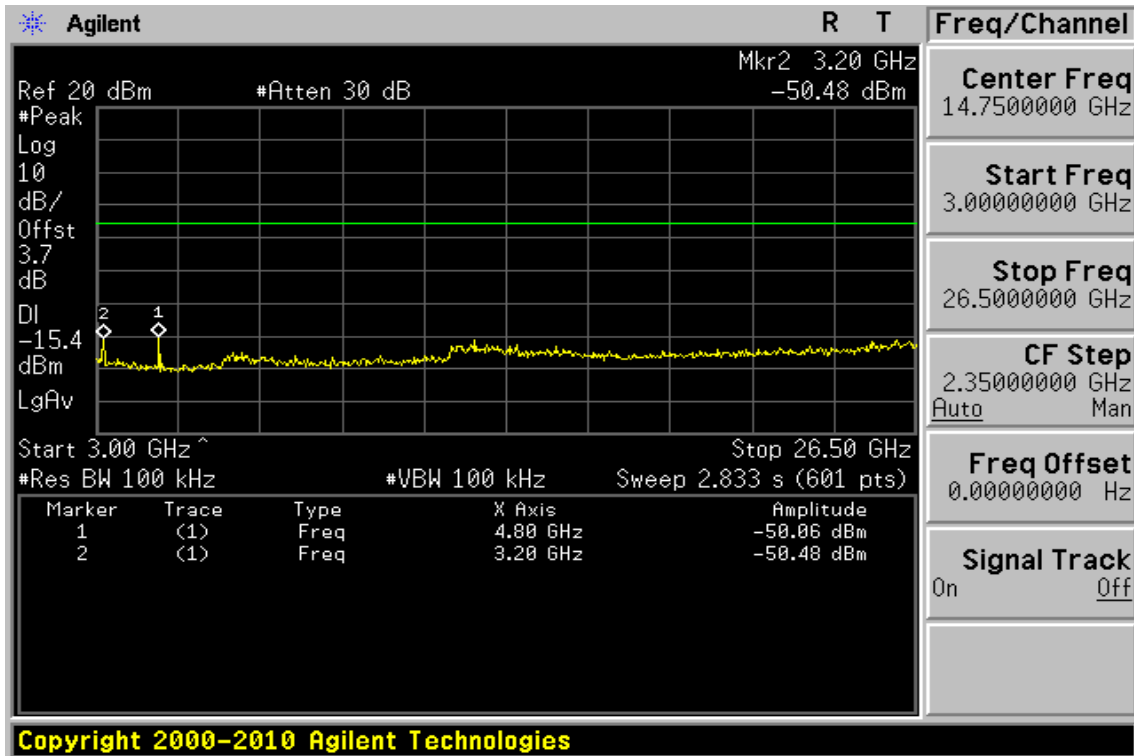
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Conducted Spurious Emission Measurement Result (Worst: EDR mode)
Ch Low 30MHz – 3GHz



Ch Low 3GHz –26.5GHz



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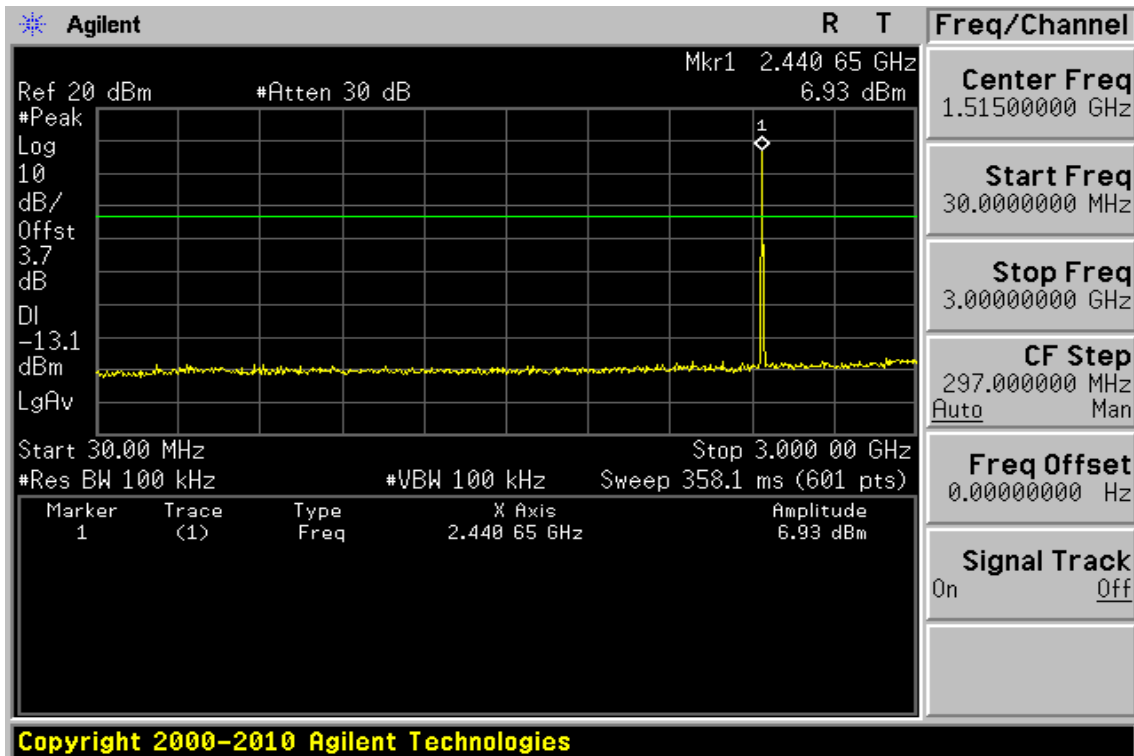
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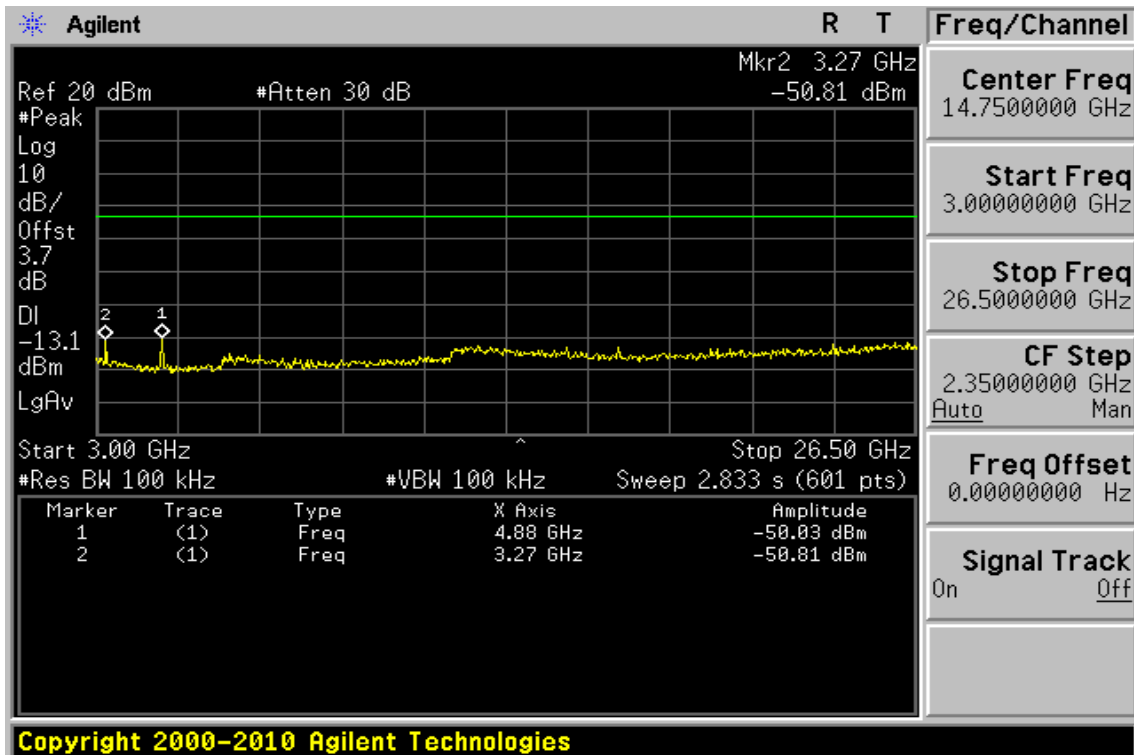
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Ch Mid 30MHz – 3GHz



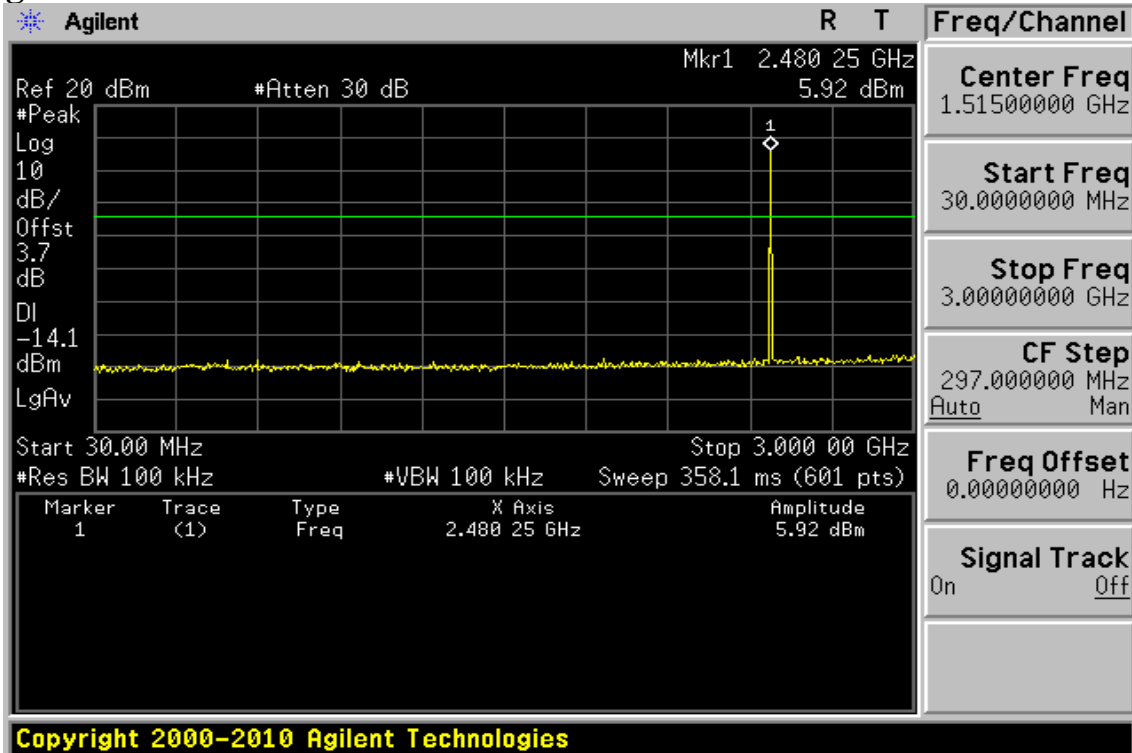
Ch Mid 3GHz – 26.5GHz



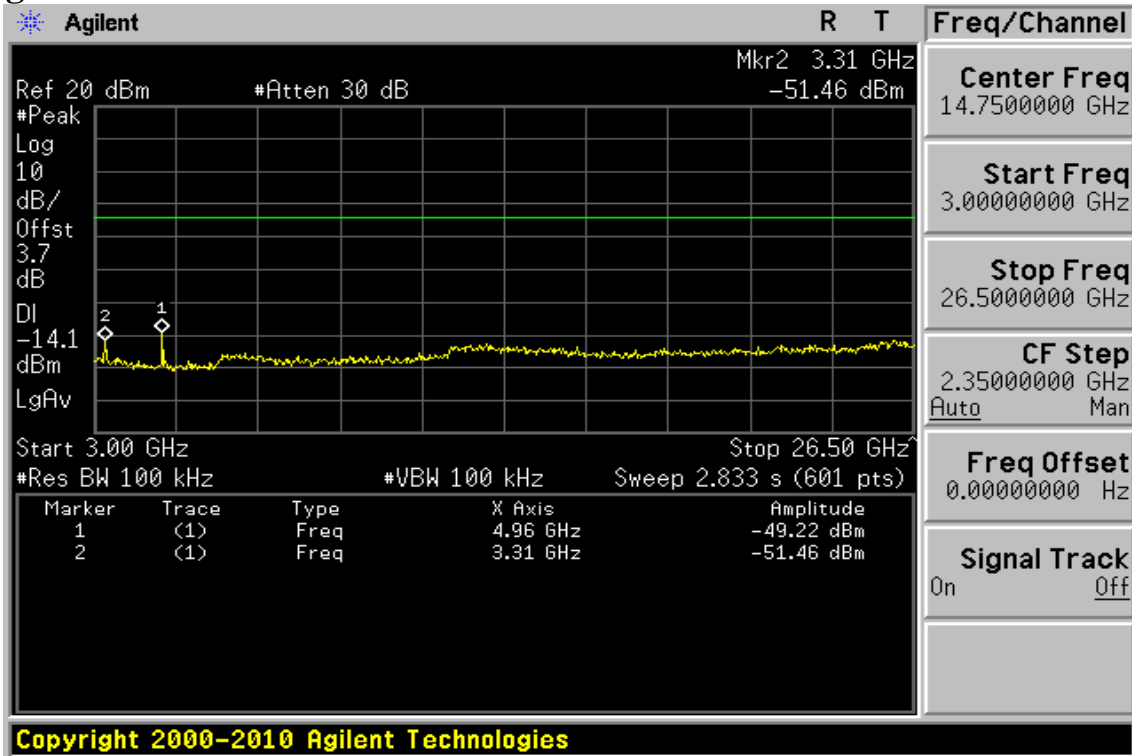
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Ch High 30MHz – 3GHz



Ch High 3GHz – 26.5GHz



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10. SPURIOUS RADIATED EMISSION TEST

10.1. Standard Applicable

According to §15.247(c), all other emissions outside these bands shall not exceed the general radiated emission limits specified in §15.209(a). And according to §15.33(a)(1), for an intentional radiator operates below 10GHz, the frequency range of measurements: to the tenth harmonic of the highest fundamental frequency or to 40GHz, whichever is lower.

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10.2. Measurement Equipment Used:

10.2.1. Radiated emission:

966 Chamber					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
EMI Test Receiver	R&S	ESCI7	100759	05/20/2011	05/19/2013
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
EXA Spectrum Analyzer	Agilent	N9010A	MY50420195	02/15/2011	02/14/2013
Spectrum Analyzer	R&S	FSV-30	101398	10/18/2011	10/17/2013
Bilog Antenna	SCHWAZBECK	VULB9168	378	01/10/2012	01/09/2014
Horn antenna	ETS.LINDGREN	3117	123995	05/19/2011	05/18/2013
Horn Antenna	Schwarzbeck	BBHA9170	185	07/11/2011	07/10/2013
Pre-Amplifier	Agilent	8447D	2944A07676	01/04/2012	01/03/2013
Pre-Amplifier	EMC Instruments Corp.	EMC0126530	980038	01/04/2012	01/03/2013
Filter 2400-2483.5 MHz	EWT	EWT-14-0166	M2	02/28/2012	02/28/2013
Attenuator	Mini-Circuit	BW-S10W2+	004	02/28/2012	02/27/2013
Turn Table	HD	DT420	N/A	N.C.R	N.C.R
Antenna Tower	HD	MA240-N	240/657	N.C.R	N.C.R
Controller	HD	HD100	N/A	N.C.R	N.C.R
Low Loss Cable	Huber Suhner	966_Rx	9	01/04/2012	01/03/2013
3m Site NSA	SGS	966 chamber	N/A	07/15/2012	07/14/2013

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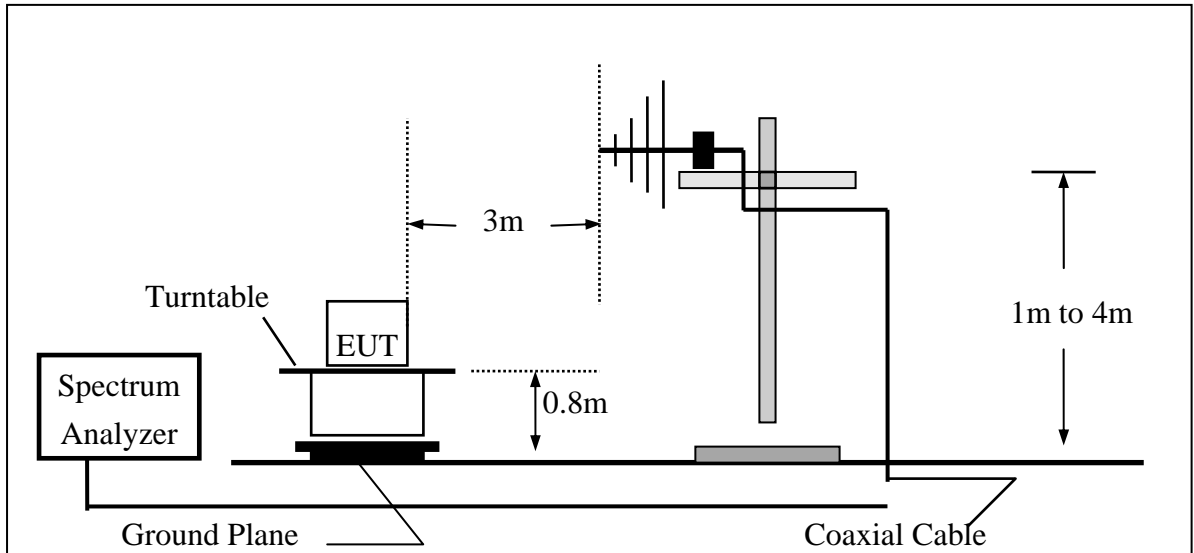
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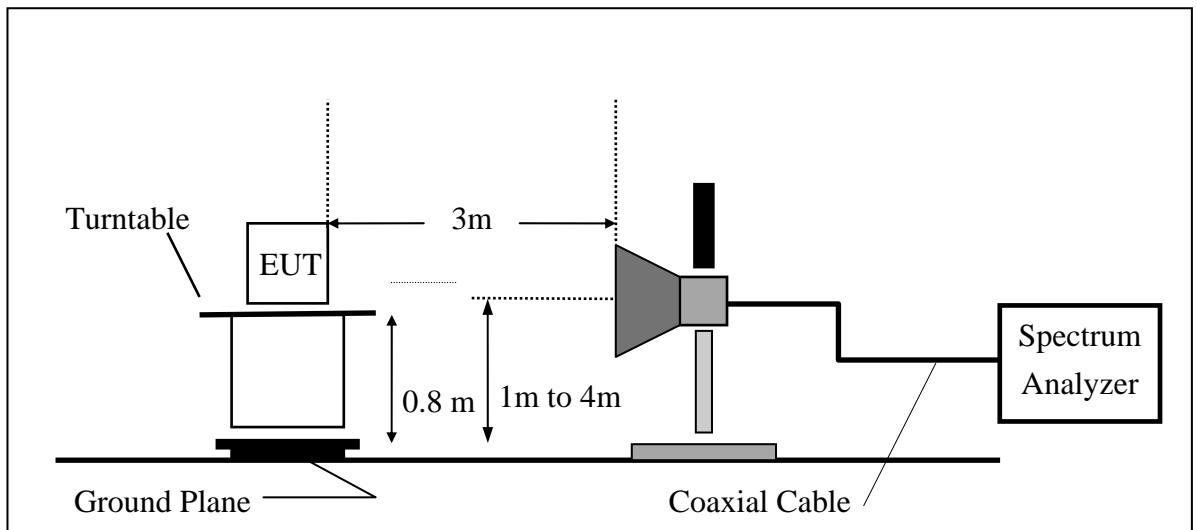
10.3. Test SET-UP:

10.3.1. Radiated emission:

(A) Radiated Emission Test Set-Up, Frequency Below 1000MHz



(B) Radiated Emission Test Set-Up Frequency Over 1 GHz



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10.4. Measurement Procedure:

1. The EUT was placed on a turn table which is 0.8m above ground plane.
2. The turn table shall rotate 360 degrees to determine the position of maximum emission level.
3. EUT is set 3m away from the receiving antenna which varied from 1m to 4m to find out the highest emissions.
4. When measurement procedures for electric field radiated emissions above 1 GHz the EUT measurement is to be made “while keeping the antenna in the ‘cone of radiation’ from that area and pointed at the area both in azimuth and elevation, with polarization oriented for maximum response.” is still within the 3dB illumination BW of the measurement antenna.
5. Maximum procedure was performed on the six highest emissions to ensure EUT compliance.
6. And also, each emission was to be maximized by changing the polarization of receiving antenna both horizontal and vertical.
7. Repeat above procedures until all frequency measured were complete.

10.5. Field Strength Calculation

The field strength is calculated by adding the Antenna Factor and Cable Factor and subtracting the Amplifier Gain and Duty Cycle Correction Factor(if any) from the measured reading. The basic equation with a sample calculation is as follows:

$$FS = RA + AF + CL - AG$$

Where	FS = Field Strength	CL = Cable Attenuation Factor (Cable Loss)
	RA = Reading Amplitude	AG = Amplifier Gain
	AF = Antenna Factor	

10.6. Measurement Result:

Note: Refer to next page spectrum analyzer data chart and tabular data sheets.

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Radiated Emission: (Worst: EDR mode)

Operation Mode	TX CH Low	Test Date	2012-07-18
Fundamental Frequency	2402 MHz	Test By	Lion
Temperature	29 °C	Pol	Ver.
Humidity	64 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
2390.00	49.72	38.69	4.68	54.40	43.37	74.00	54.00	-10.63	Average

Operation Mode	TX CH Low	Test Date	2012-07-18
Fundamental Frequency	2402 MHz	Test By	Lion
Temperature	29 °C	Pol	Hor.
Humidity	64 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
2390.00	49.72	38.69	5.30	55.02	43.99	74.00	54.00	-10.01	Average

Remark :

- (1) Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Operation Mode	TX CH High	Test Date	2012-07-18
Fundamental Frequency	2480 MHz	Test By	Lion
Temperature	29 °C	Pol	Ver.
Humidity	64 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
2483.50	51.23	38.87	5.26	56.49	44.13	74.00	54.00	-9.87	Average

Operation Mode	TX CH High	Test Date	2012-07-18
Fundamental Frequency	2480 MHz	Test By	Lion
Temperature	29 °C	Pol	Hor.
Humidity	64 %		

Freq. (MHz)	Peak	AV	Ant./CL CF(dB)	Actual FS		Peak	AV	Margin (dB)	Remark
	Reading (dBuV)	Reading (dBuV)		Peak (dBuV/m)	AV (dBuV/m)	Limit (dBuV/m)	Limit (dBuV/m)		
2483.50	51.67	38.70	6.29	57.96	44.99	74.00	54.00	-9.01	Average

Remark :

- (1) Data of measurement within this frequency range shown “ - ” in the table above means the reading of emissions are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.
- (2) Radiated emissions measured in frequency above 1000MHz were made with an instrument using Peak detector mode and average detector mode of the emission shown in Actual FS column.
- (3) Spectrum Peak Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 3MHz, Sweep time= 200 ms.
- (4) Spectrum AV Setting : 1GHz- 26GHz, RBW= 1MHz, VBW= 10Hz, Sweep time= 200 ms.

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Radiated Spurious Emission Measurement Result (worst case EDR mode)

Operation Band	:EDR	Test Date	:2012-07-18
Fundamental Frequency	:2402 MHz	Temp./Humi.	:29 deg_C / 64 RH
Operation Mode	:TX LOW	Engineer	:Lion
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
43.58	S	Peak	49.48	-13.70	35.78	40.00	-4.22
117.30	S	Peak	40.19	-14.85	25.34	43.50	-18.16
366.59	S	Peak	28.89	-11.48	17.41	46.00	-28.59
469.41	S	Peak	30.99	-9.90	21.09	46.00	-24.91
587.75	S	Peak	29.55	-7.82	21.73	46.00	-24.27
878.75	S	Peak	27.35	-3.22	24.13	46.00	-21.87
4804.00	H	Peak	34.79	9.65	44.44	74.00	-29.56
7206.00	H	---					
9608.00	H	---					
12010.00	H	---					
14412.00	H	---					
16814.00	H	---					
19216.00	H	---					
21618.00	H	---					
24020.00	H	---					

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Operation Band	:EDR	Test Date	:2012-07-18
Fundamental Frequency	:2402 MHz	Temp./Humi.	:29 deg_C / 64 RH
Operation Mode	:TX LOW	Engineer	:Lion
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq.	Note	Detector	Spectrum	Factor	Actual	Limit	Margin
MHz	F/H/E/S	Mode	Reading Level	dB	FS	@3m	dB
		PK/QP/AV	dBμV		dBμV/m	dBμV/m	
43.58	S	Peak	35.82	-13.70	22.12	40.00	-17.88
109.54	S	Peak	40.32	-15.81	24.51	43.50	-18.99
312.27	S	Peak	30.21	-12.27	17.94	46.00	-28.06
495.60	S	Peak	28.60	-9.63	18.97	46.00	-27.03
629.46	S	Peak	29.62	-6.94	22.68	46.00	-23.32
786.60	S	Peak	31.31	-4.38	26.93	46.00	-19.07
4804.00	H	Peak	34.47	9.69	44.16	74.00	-29.84
7206.00	H	---					
9608.00	H	---					
12010.00	H	---					
14412.00	H	---					
16814.00	H	---					
19216.00	H	---					
21618.00	H	---					
24020.00	H	---					

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Operation Band	:EDR	Test Date	:2012-07-18
Fundamental Frequency	:2441 MHz	Temp./Humi.	:29 deg_C / 64 RH
Operation Mode	:TX MID	Engineer	:Lion
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
43.58	S	Peak	49.55	-13.70	35.85	40.00	-4.15
109.54	S	Peak	41.02	-15.81	25.21	43.50	-18.29
468.44	S	Peak	30.88	-9.90	20.98	46.00	-25.02
594.54	S	Peak	28.03	-7.68	20.35	46.00	-25.65
742.95	S	Peak	27.62	-5.08	22.54	46.00	-23.46
874.87	S	Peak	27.26	-3.30	23.96	46.00	-22.04
4882.00	H	Peak	34.66	10.16	44.82	74.00	-29.18
7323.00	H	---					
9764.00	H	---					
12205.00	H	---					
14646.00	H	---					
17087.00	H	---					
19528.00	H	---					
21969.00	H	---					
24410.00	H	---					

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Operation Band	:EDR	Test Date	:2012-07-18
Fundamental Frequency	:2441 MHz	Temp./Humi.	:29 deg_C / 64 RH
Operation Mode	:TX MID	Engineer	:Lion
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
43.58	S	Peak	36.77	-13.70	23.07	40.00	-16.93
109.54	S	Peak	40.73	-15.81	24.92	43.50	-18.58
461.65	S	Peak	28.59	-9.94	18.65	46.00	-27.35
667.29	S	Peak	28.08	-6.25	21.83	46.00	-24.17
785.63	S	Peak	33.02	-4.39	28.63	46.00	-17.37
865.17	S	Peak	27.86	-3.45	24.41	46.00	-21.59
4882.00	H	Peak	34.12	10.11	44.23	74.00	-29.77
7323.00	H	---					
9764.00	H	---					
12205.00	H	---					
14646.00	H	---					
17087.00	H	---					
19528.00	H	---					
21969.00	H	---					
24410.00	H	---					

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Operation Band	:EDR	Test Date	:2012-07-18
Fundamental Frequency	:2480 MHz	Temp./Humi.	:29 deg_C / 64 RH
Operation Mode	:TX HIGH	Engineer	:Lion
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:VERTICAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
43.58	S	Peak	49.46	-13.70	35.76	40.00	-4.24
109.54	S	Peak	41.31	-15.81	25.50	43.50	-18.00
375.32	S	Peak	28.66	-11.34	17.32	46.00	-28.68
468.44	S	Peak	31.27	-9.90	21.37	46.00	-24.63
673.11	S	Peak	28.61	-6.14	22.47	46.00	-23.53
890.39	S	Peak	27.53	-3.01	24.52	46.00	-21.48
4960.00	H	Peak	35.16	10.03	45.19	74.00	-28.81
7440.00	H	---					
9920.00	H	---					
12400.00	H	---					
14880.00	H	---					
17360.00	H	---					
19840.00	H	---					
22320.00	H	---					
24800.00	H	---					

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Operation Band	:EDR	Test Date	:2012-07-18
Fundamental Frequency	:2480 MHz	Temp./Humi.	:29 deg_C / 64 RH
Operation Mode	:TX HIGH	Engineer	:Lion
EUT Pol.	:E1 Plan	Measurement Antenna Pol.	:HORIZONTAL

Actual FS(dBμV/m) = SPA. Reading level(dBμV) + Factor(dB)

Factor(dB) = Antenna Factor(dBμV/m) + Cable Loss(dB) – Pre_Amplifier Gain(dB)

Note : “F” : denotes Fundamental Frequency. ; “H” : denotes Harmonic Frequency.

“E” : denotes Band Edge Frequency. ; “S” : denotes Spurious Frequency.

“---“ : denotes Noise Floor.

Freq. MHz	Note F/H/E/S	Detector Mode PK/QP/AV	Spectrum Reading Level dBμV	Factor dB	Actual FS dBμV/m	Limit @3m dBμV/m	Margin dB
43.58	S	Peak	36.24	-13.70	22.54	40.00	-17.46
109.54	S	Peak	40.90	-15.81	25.09	43.50	-18.41
312.27	S	Peak	30.67	-12.27	18.40	46.00	-27.60
462.62	S	Peak	28.38	-9.94	18.44	46.00	-27.56
665.35	S	Peak	29.07	-6.28	22.79	46.00	-23.21
787.57	S	Peak	31.25	-4.37	26.88	46.00	-19.12
4960.00	H	Peak	34.91	9.88	44.79	74.00	-29.21
7440.00	H	---					
9920.00	H	---					
12400.00	H	---					
14880.00	H	---					
17360.00	H	---					
19840.00	H	---					
22320.00	H	---					
24800.00	H	---					

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11. FREQUENCY SEPARATION

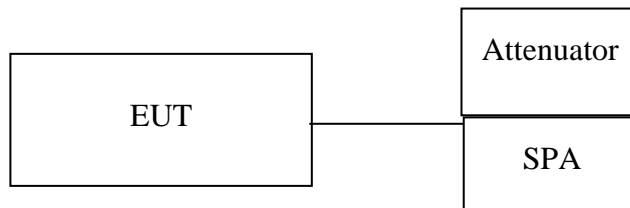
11.1. Standard Applicable

According to §15.247(a)(1), Frequency hopping systems shall have hopping channel carrier frequencies separated by minimum of 25KHz or the 2/3*20dB bandwidth of the hopping channel, whichever is greater.

11.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013

11.3. Test Set-up:



11.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = middle of hopping channel .
4. Set the spectrum analyzer as RBW,VBW=100KHz/100KHz, Adjust Span to 5.0 MHz, Sweep = auto.
5. Max hold. Mark 3 Peaks of hopping channel and record the 3 peaks frequency.

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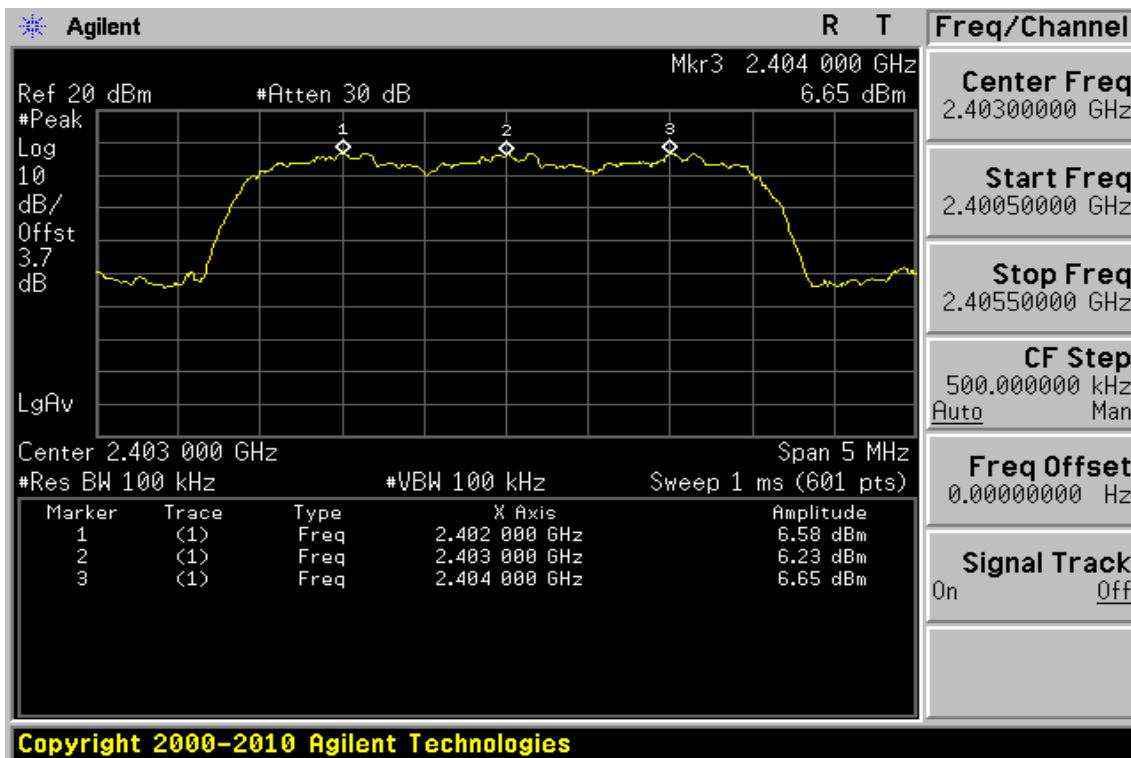
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11.5. Measurement Result:

Channel separation (MHz)	Limit	Result
1	$\geq 25\text{KHz}$ or 2/3 times 20dB bandwidth	PASS

Note: Refer to next page for plots.

Frequency Separation Test Data



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12. NUMBER OF HOPPING FREQUENCY

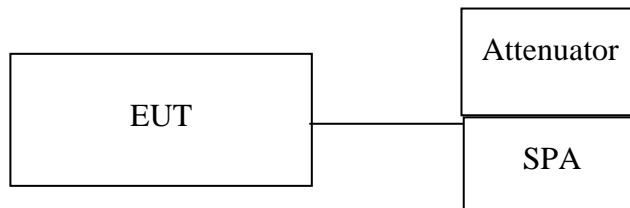
12.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz bands shall use at least 15 hopping frequencies.

12.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013

12.3. Test Set-up:



12.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set spectrum analyzer Start=2400MHz, Stop = 2483.5MHz, Sweep = auto.
4. Set the spectrum analyzer as RBW, VBW=430KHz/1.3MHz,
5. Max hold, view and count how many channel in the band.

12.5. Measurement Result:

Note: Refer to next page for plots.

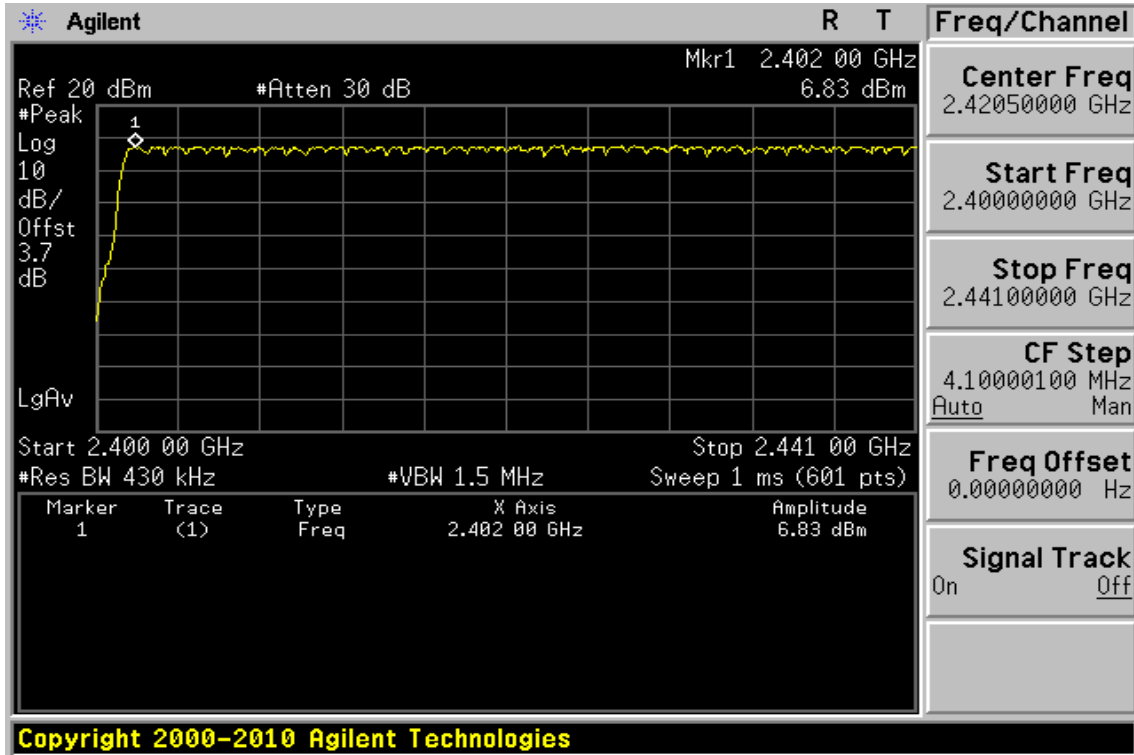
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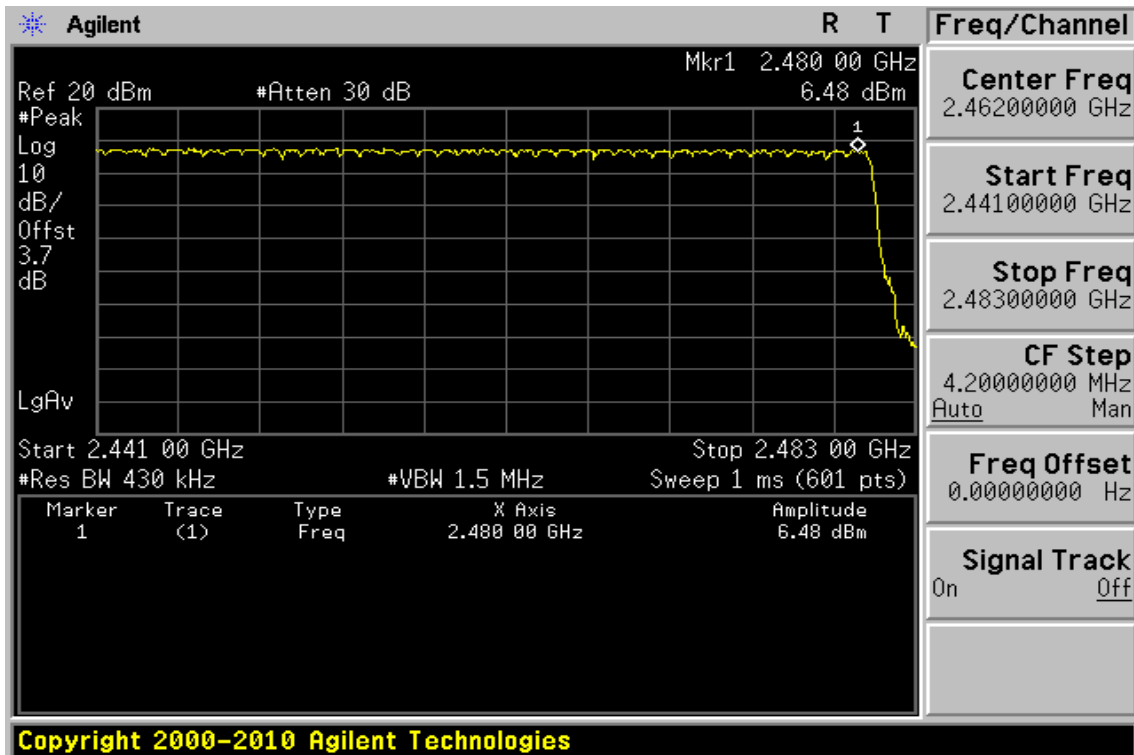
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Channel Number

2.4 GHz – 2.441GHz



2.441 GHz – 2.4835GHz



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13. TIME OF OCCUPANCY (DWELL TIME)

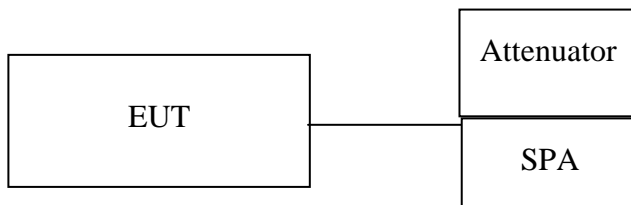
13.1. Standard Applicable

According to §15.247(a)(1)(iii), Frequency hopping systems operating in the 2400MHz-2483.5 MHz. The average time of occupancy on any frequency shall not greater than 0.4 s within period of 0.4 seconds multiplied by the number of hopping channel employed.

13.2. Measurement Equipment Used:

Conducted Emission Test Site					
EQUIPMENT TYPE	MFR	MODEL NUMBER	SERIAL NUMBER	LAST CAL.	CAL DUE.
Spectrum Analyzer	Agilent	E4446A	MY51100003	04/15/2011	04/14/2013
Spectrum Analyzer	Agilent	E4440A	MY45304525	03/17/2012	03/16/2014
DC Block	Mini-Circuits	BLK-18-S+	1	02/28/2012	02/27/2013
Low Loss Cable	HUBER+SUHNER	SUCOFLEX 104PEA	N/A	01/05/2012	01/04/2013
Attenuator	Mini-Circuit	BW-S10W2+	002	02/28/2012	02/27/2013

13.3. Test Set-up:



13.4. Measurement Procedure:

1. Place the EUT on the table and set it in transmitting mode.
2. Remove the antenna from the EUT and then connect a low loss RF cable from the antenna port to the spectrum analyzer.
3. Set center frequency of spectrum analyzer = operating frequency.
4. Set the spectrum analyzer as RBW,VBW=1MHz/1MHz, Span = 0Hz , Adjust Sweep = 2ms-5ms.
5. Repeat above procedures until all frequency measured were complete.

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13.5. Measurement Result

A period time = 0.4 (s) * 79 = 31.6 (s)

CH Low DH1 time slot = 0.383 (ms) * (1600/2/79) * 31.6 = 122.56 (ms)

DH3 time slot = 1.633 (ms) * (1600/4/79) * 31.6 = 261.28 (ms)

DH5 time slot = 2.870 (ms) * (1600/6/79) * 31.6 = 306.13 (ms)

CH Mid DH1 time slot = 0.383 (ms) * (1600/2/79) * 31.6 = 122.56 (ms)

DH3 time slot = 1.633 (ms) * (1600/4/79) * 31.6 = 261.28 (ms)

DH5 time slot = 2.870 (ms) * (1600/6/79) * 31.6 = 306.13 (ms)

CH High DH1 time slot = 0.383 (ms) * (1600/2/79) * 31.6 = 122.56 (ms)

DH3 time slot = 1.633 (ms) * (1600/4/79) * 31.6 = 261.28 (ms)

DH5 time slot = 2.870 (ms) * (1600/6/79) * 31.6 = 306.13 (ms)

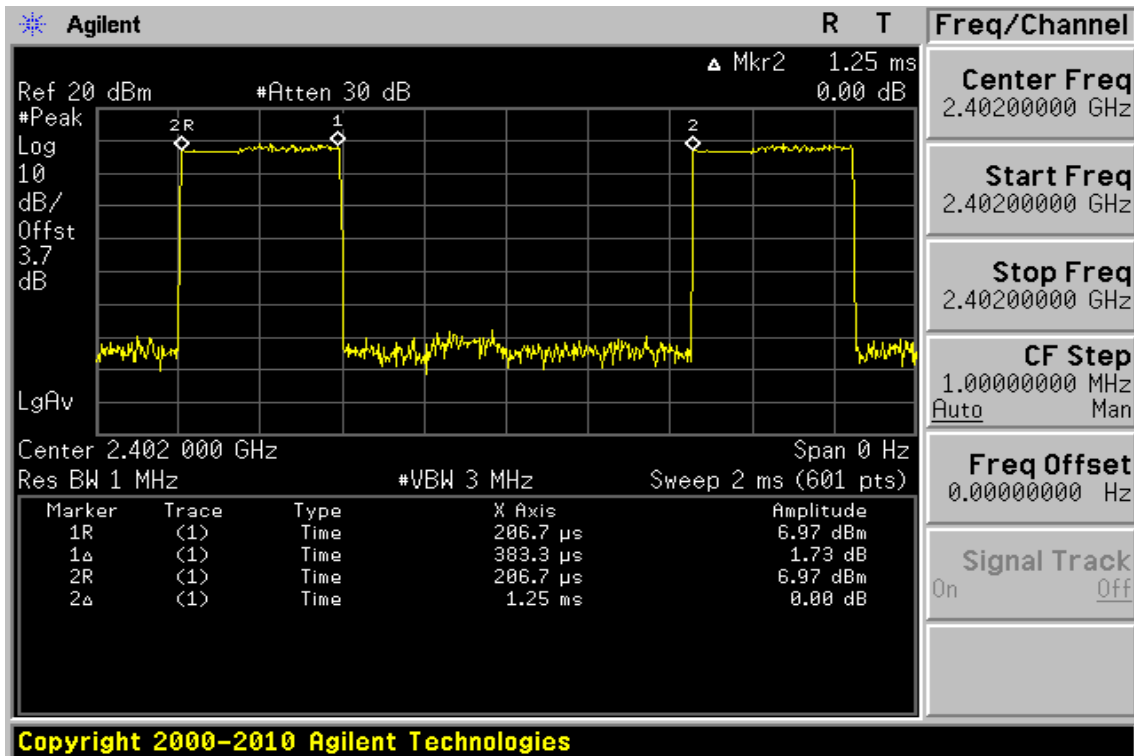
Note: Refer to next page for plots.

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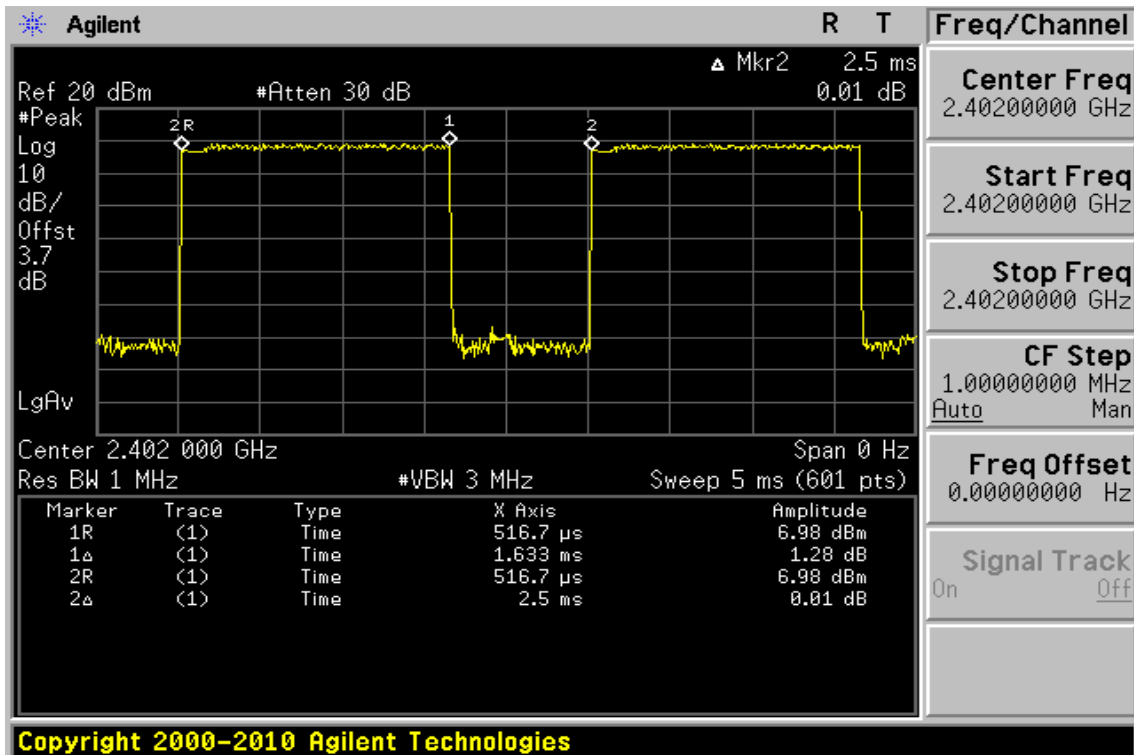
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CH-Low

DH1



DH3

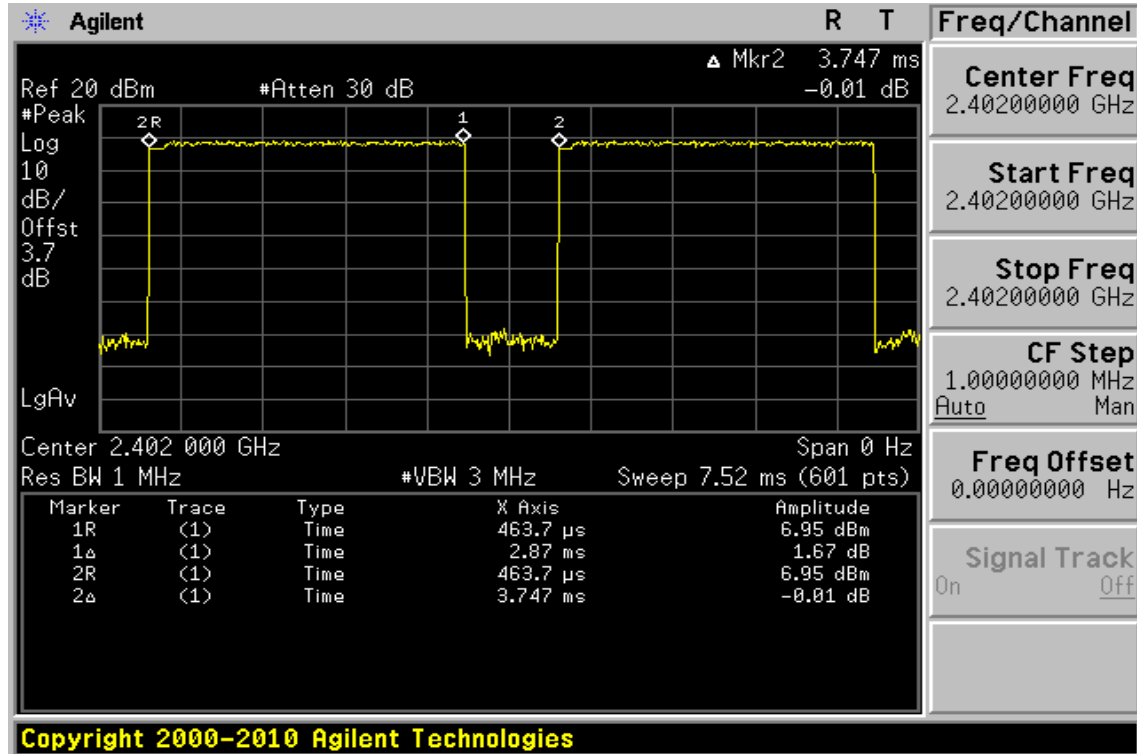


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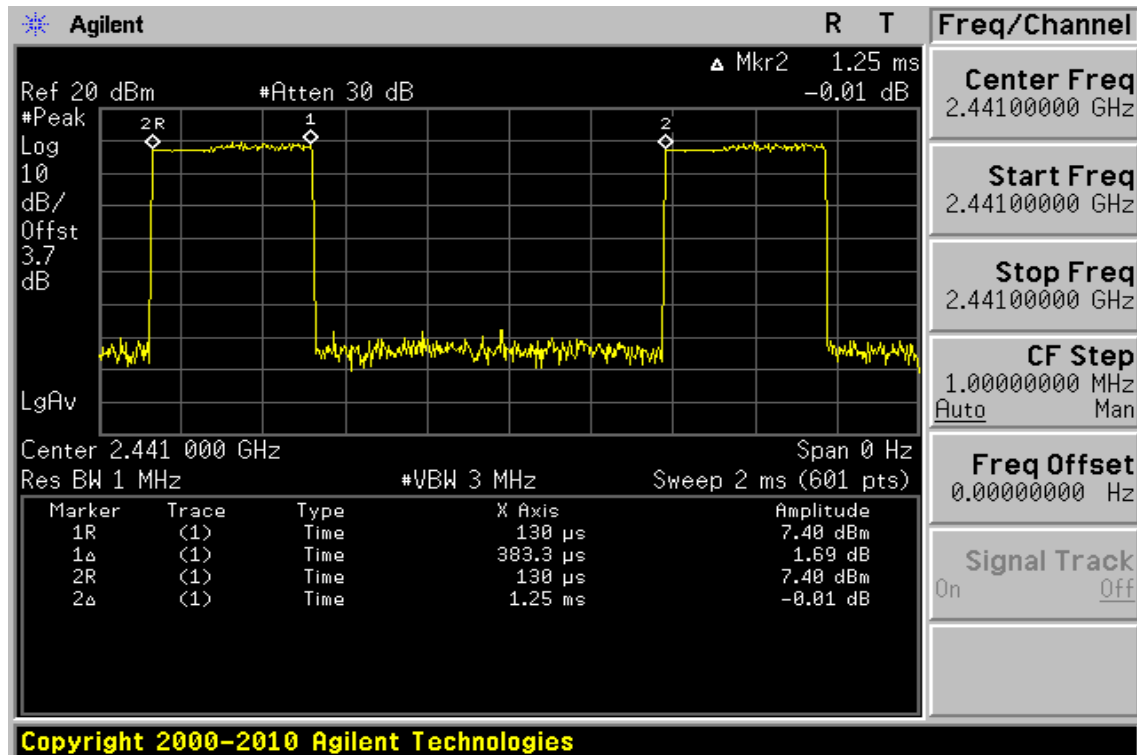
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DH5



CH-Mid

DH1



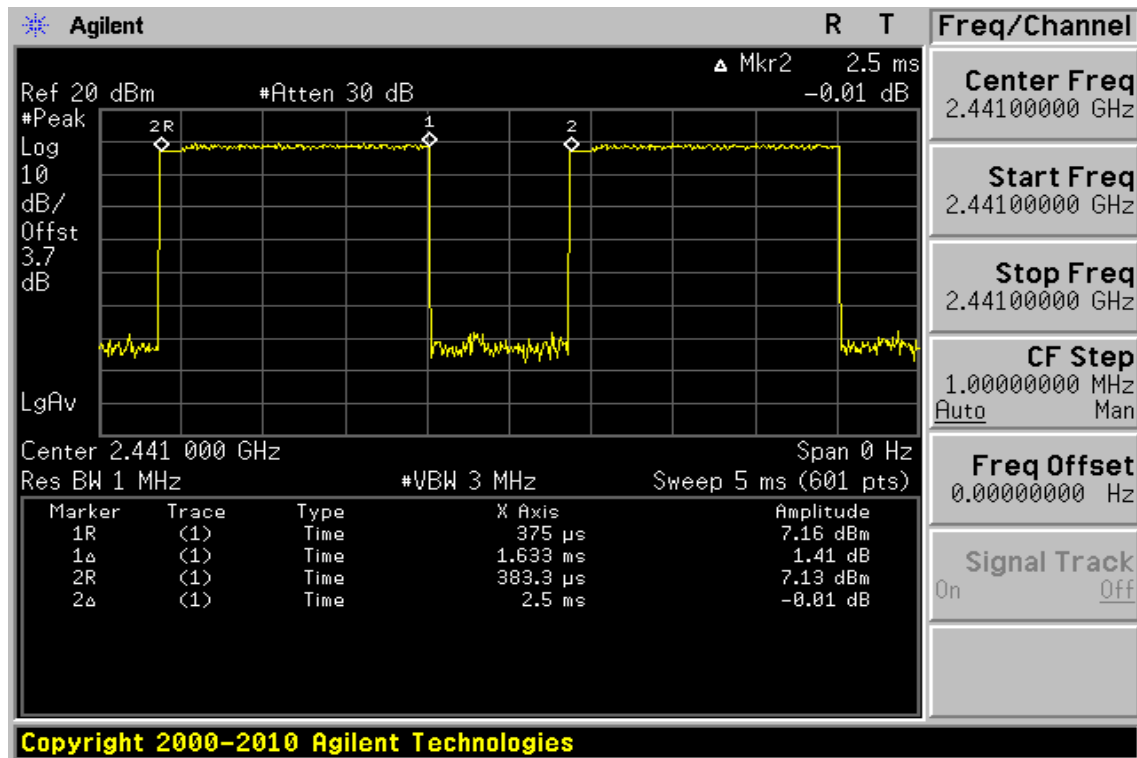
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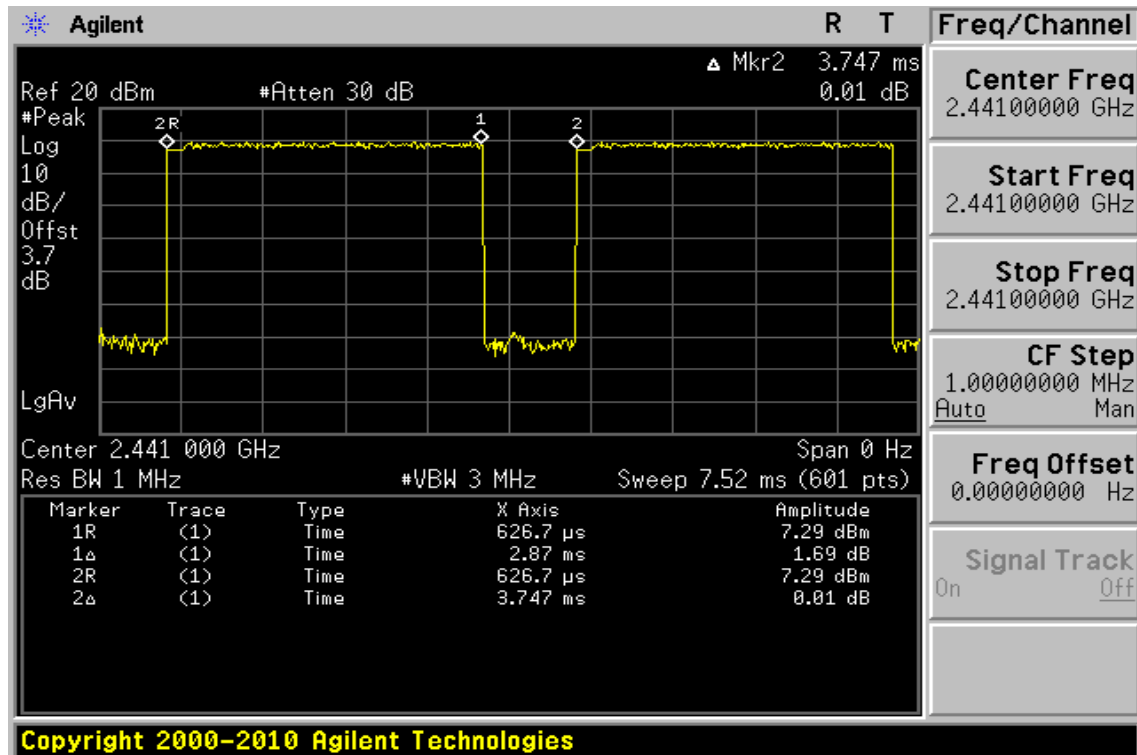
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DH3



DH5



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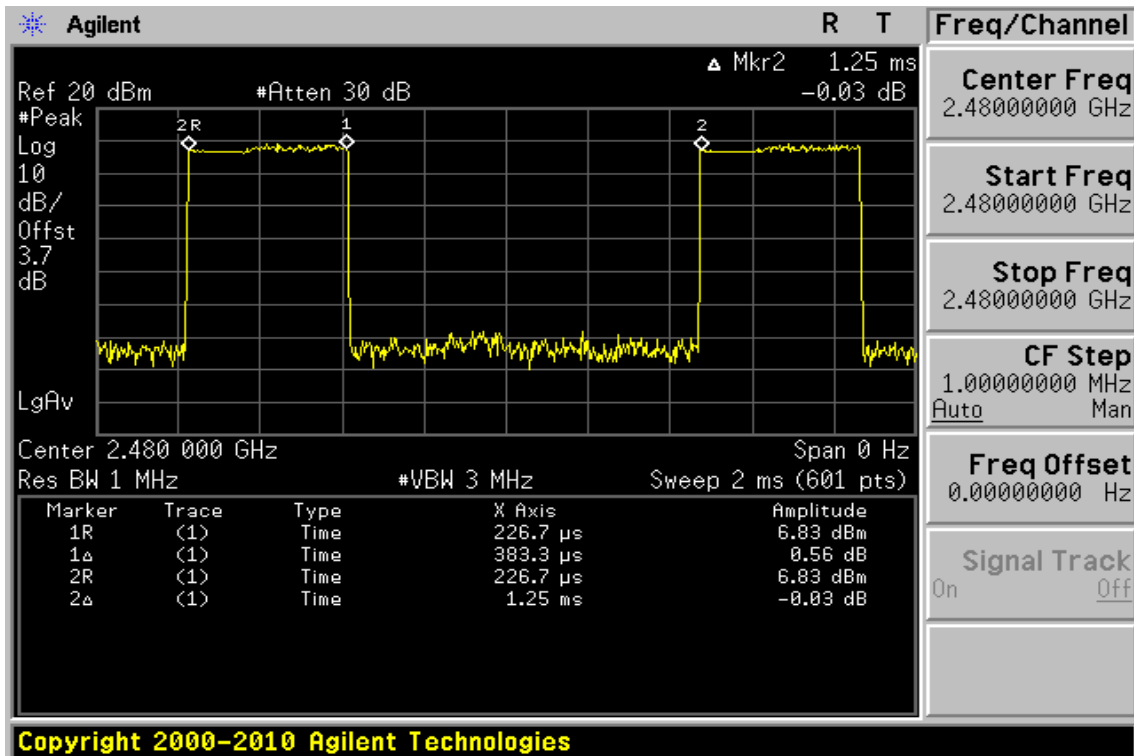
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f (886-2) 2298-0488

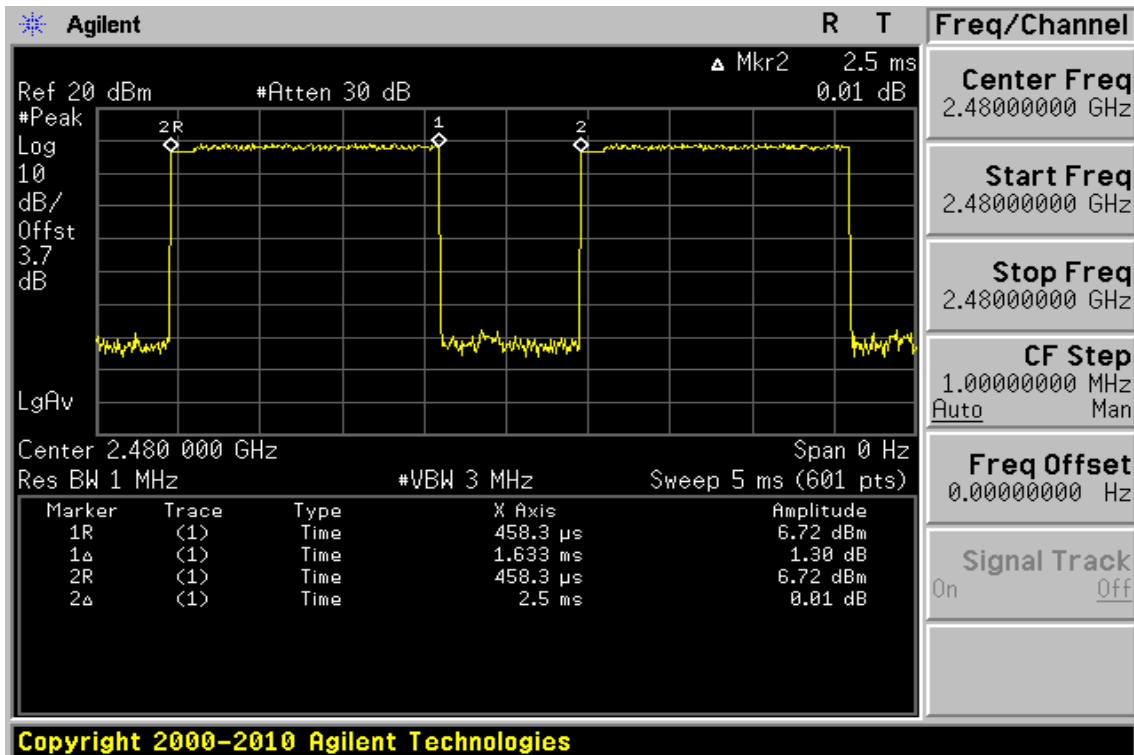
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CH-High DH1



DH3

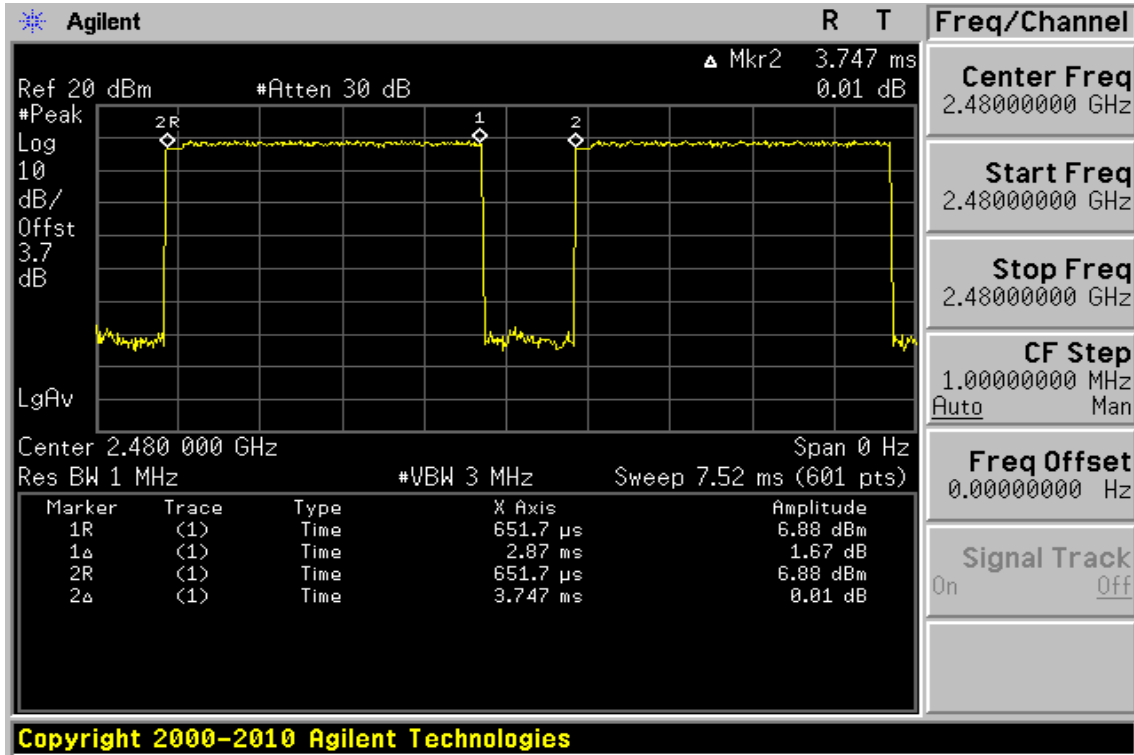


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DH5



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14. ANTENNA REQUIREMENT

14.1. Standard Applicable

For intentional device, according to §15.203, an intentional radiator shall be designed to ensure that no antenna other than furnished by the responsible party shall be used with the device.

And according to §15.247(4)(1), system operating in the 2400-2483.5MHz bands that are used exclusively for fixed, point-to-point operations may employ transmitting antennas with directional gain greater than 6dBi provided the maximum peak output power of the intentional radiator is reduced by 1 dB for every 3 dB that the directional gain of the antenna exceeds 6 dBi.

14.2. Antenna Connected Construction

The directional gains of antenna used for transmitting is -1.6dBi, and the antenna connector is designed with permanent attachment and no consideration of replacement. Please see EUT photo for details.

Unless otherwise stated the results shown in this test report refer only to the sample(s) tested and such sample(s) are retained for 90 days only.
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